

SEPT. 1975 75 CENTS

Popular Mechanics

10 hideaways you
make to protect
valuables

SOLAR HEATING:
How to tell if it's
really for you

17 newest
ultralight
headphones
for hi-fi

CARS: How
they shape up
for the '80s

Table-saw
tricks with a
portable saw

PREVIEWS:
'76 outboards
and new TVs

How to
be happy
painting
your house



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Lush greenhouse in your window—a week-end project designed for PM by John Gaynor.
Photo: Chuck Rogers, Black Star

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SPECIAL FEATURES:

10 hideaways you make to protect your valuables. Try these clever uses of unlikely places to outwit thieves—even if they read this story. Page 74.

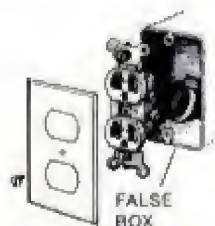
Sunpower: The heat's on for real. Solar-powered heating-cooling units are now on the market. Here's how to tell if they're really for you. Page 63.

"Open-air" headsets: Easier on your ears. 17 new ultralight hi-fi headphones that sit on your ears, rather than seal them, are less tiring. Page 60.

Cars of the 1980s: What they will be like. Detroit Editor Robert Lund interviews spokesmen from the four automakers about major changes. Page 49.

Table-saw tricks with a portable saw. The circular-saw know-how you need to virtually duplicate what you can do on a bench or radial saw. Page 96.

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LETTERS

TO THE EDITOR

Making hay with old motor oil

In *All About Oil* (page 70, July '75) you said there was no way to dispose of oil. I disagree. Having lived on a farm for 16 years, I can say that a Holstein cow will eat and enjoy any old oil you put in front of her. Of course, I don't regularly feed them oil, but I wonder if the bossies would like this synthetic stuff. At \$5 a quart, I should say not!

JOHN BUNTER
ORFORD, N.H.

The farm boys in the office here have never heard of feeding Holsteins old oil. In fact, they think you'll wind up with SAE 10-40W milk or a dreadfully sick cow.

A winner with solar power

This 1/4 scale model of *First Plug-In Solar Furnace* (page 102, Feb. '75) was built by our 11-year-old-son, Glen, with the help of his father. It was for his school Science Fair; he along with two others took first place.



The panel of rounded cups was made by using tart tins (aluminum) which he separated and sanded smooth. The front reflector panel was covered with aluminum foil. The motors are from sewing machines (sob). The blowers are made by using a squirrel-cage blower encased in a shortened coffee can. The "Thermopane" was created by taking two sheets of glass, laying a row of toothpicks (flat type) end to end around the edge of one sheet and gluing the other sheet on top of this.

He took it outside on a day that was sunny and 50° F. He opened the reflector panels and in five minutes the inside temperature had gone up to 105°.

JO ANNA BALDWIN
ANDERSON, IND.

Never a complaint with U.S. cars

Regarding the *Owners Report on BMW* (page 92, July '75), what are these inexperienced young punks bragging about? Why don't they buy American cars and keep American auto workers working? I am 72 years old, have worn out seven American-made cars and when I say worn out I mean it . . . 90,000 to 190,000 miles with never a complaint.

G.L. BRADBURY
BENSON, ARIZ.

Transatlantic balloon

There's an error on the cover of your June issue. In the artist's depiction of the transatlantic balloon, a suspended flag was shown flapping in the wind. Due to the fact that a balloon travels with the wind, this would not happen.

KENDAL W. GREEN
LANCASTER, PA.

That's so in a steady wind. But in the turbulent air conditions depicted in the painting, it would flap. In fact, Bob Sparks, the pilot, reported that his 15-foot flag flipped up and into the gondola during the storm that forced him into the Atlantic during his 1973 crossing attempt.

Waging the fight against car rust

The article on *Rust—Your Car's Worst Enemy* (page 95, July '75) was timely and effective in calling attention to an important economic problem. However, you missed the boat on unitized bodies, at least in the stress of the article.

It is true that metal thickness is a proportional cause of early rusting through, but the desires for lower initial cost and higher miles-per-gallon (determined primarily by the weight of the car) are powerful forces against the prospect of getting heavier sheet metal.

More fundamental from a design viewpoint are the closed boxes and dirt-traps which exist in most body designs. These are not necessary, but merely reflect poor design, and the sooner they are eliminated, the better for snow-country car owners.

There is a car today whose body is unitized, yet which avoids most

(Please turn to page 6)

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LETTERS

(Continued from page 5)

closed-boxes and dirt-traps in its external shell—the Saab 99.

In this car, virtually all of the external body panels are open to the inside of the vehicle—including all four fenders! The fenders are constructed with a wheel housing plus external skirts front and rear. There are thus no boxes and no dirt-traps. With dry internal conditions and complete access inside for repainting if necessary, these fenders will last indefinitely.

I don't think that Saab has all the rust answers, but as far as the external body shell is concerned, I believe the 99 will outlast any other car on the road.

R.G. ELMENDORF
BAIRD FORD, PA.

How refreshing it is to see that someone cares about the consumer in this regard. You are quite right to suggest that it is a safety problem as well as an esthetic one. How many times I see carloads of kids in these rusted hulks in near-zero weather. With rusted-out mufflers and floor-pans and closed windows, they are cause for alarm.

I also agree with you in the matter of designing for rust prevention. Late-model Big Three designs with severe body tuck-under are absurd. Not only are they a contributing factor to rust but they make it virtually impossible to keep the car clean in weather such as we have in Michigan.

If anything, I believe you were overstating a car's life before rusting through. My experience and observation have shown two-year-old Vegas and Pintos with large body holes. My '72 Dodge pickup, purchased new, had holes through the box and cab after only two winters. The frame had been flaking off large pieces of rust until it was noticeably thinner when I sold it.

Contrary to your statement that unitized bodies are rust-prone, I've noticed that structural areas are well-protected on Chrysler Corp. cars, although sheet-metal areas rust about as fast as those on Ford or GM cars. The VW beetle may be an archaic design but it sure resists rust.

I feel that Chrysler Corp. is well-advanced in the area of underbody rust (I just inspected my '71 Plymouth Fury) and needs to concentrate on outer-body sheet metal. GM and Ford can afford to be lax in protecting underbody sheet metal since the separate frame will still hold a rusty car together.

GERALD W. MANTELA
FENTON, MICH.

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SCIENCE WORLDWIDE



Fuel-cell power for rescue sub

Improved performance is looked for when the Navy's Deep Submergence Rescue Vehicle (DSRV) is equipped with two fuel-cell powerplants similar to the test unit shown in the inset above.

The DSRV is designed to rescue crews from disabled submarines and is capable of diving to 5000 feet. The hydrogen-oxygen fuel cells, which directly convert chemical to electrical energy, will permit the DSRV to carry out an extended mission without having to pause to recharge its batteries. Installation of the new prime power sources is slated for April, 1977.

Lockheed Aircraft Corp. built two DSRVs for the Navy—the first of which was put in service in 1970—and United Technologies is producer of the fuel-cell powerplants.

Now: a laser saw for wood

Use of the laser to cut wood—a new application of the scientific marvel developed in the 1950s—has been announced by Curtis C. Peters, an engineer at Forest Products Laboratory, Madison, Wis. This has several advantages. "There is no sawdust, the cut is very narrow, complicated

designs can be cut readily, and there is no tool wear," Peters explains. "In addition, the noise level is low and the cut surfaces are much smoother than those produced by most saws today." But Peters doesn't think the laser will replace the metal saw for most applications. High initial cost and heavy power requirements are distinct drawbacks.

Pig valves for humans

A highly successful heart valve partially composed of tissue from a pig's heart is now being used in humans, according to heart surgeons at Stanford University Medical Center. The valve has had no mechanical failures, and its use has resulted in a low incidence of thromboembolism—the blocking of a blood vessel by a clot or other mass—one of the major causes of death following valve replacement.

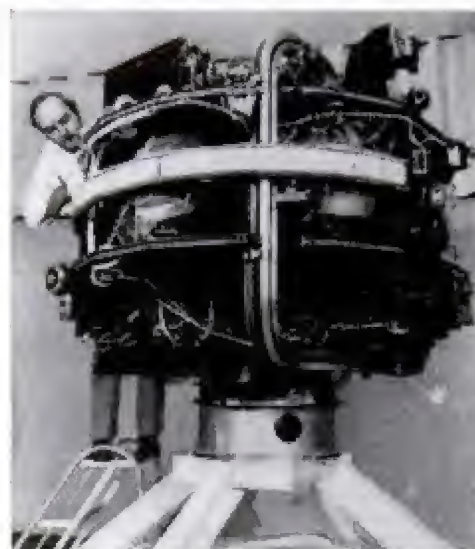
The device consists of a preserved pig valve mounted on a flexible polypropylene platform covered with Dacron. The mitral and aortic valves control the flow of blood in and out of the heart. When they become diseased, the heart becomes sluggish and the patient, unless the problem is corrected, eventually dies.

Developments on ozone front

Concluding a four-month investigation, a federal scientific task force recently announced that there is "legitimate cause for concern" that fluorocarbon gases used in refrigeration, airconditioning and as an aerosol propellant are damaging the Earth's protective ozone shield. Unless new evidence indicates otherwise, the task-force report said, a restriction on the use of fluorocarbon gases should be made effective by 1978.

The layer of ozone, which starts at ground level and extends to about 30 miles above the Earth, acts as a buffer against ultraviolet radiation. Ultraviolet rays can cause skin cancer in humans. The reaction of fluorocarbons with ozone causes it to break down.

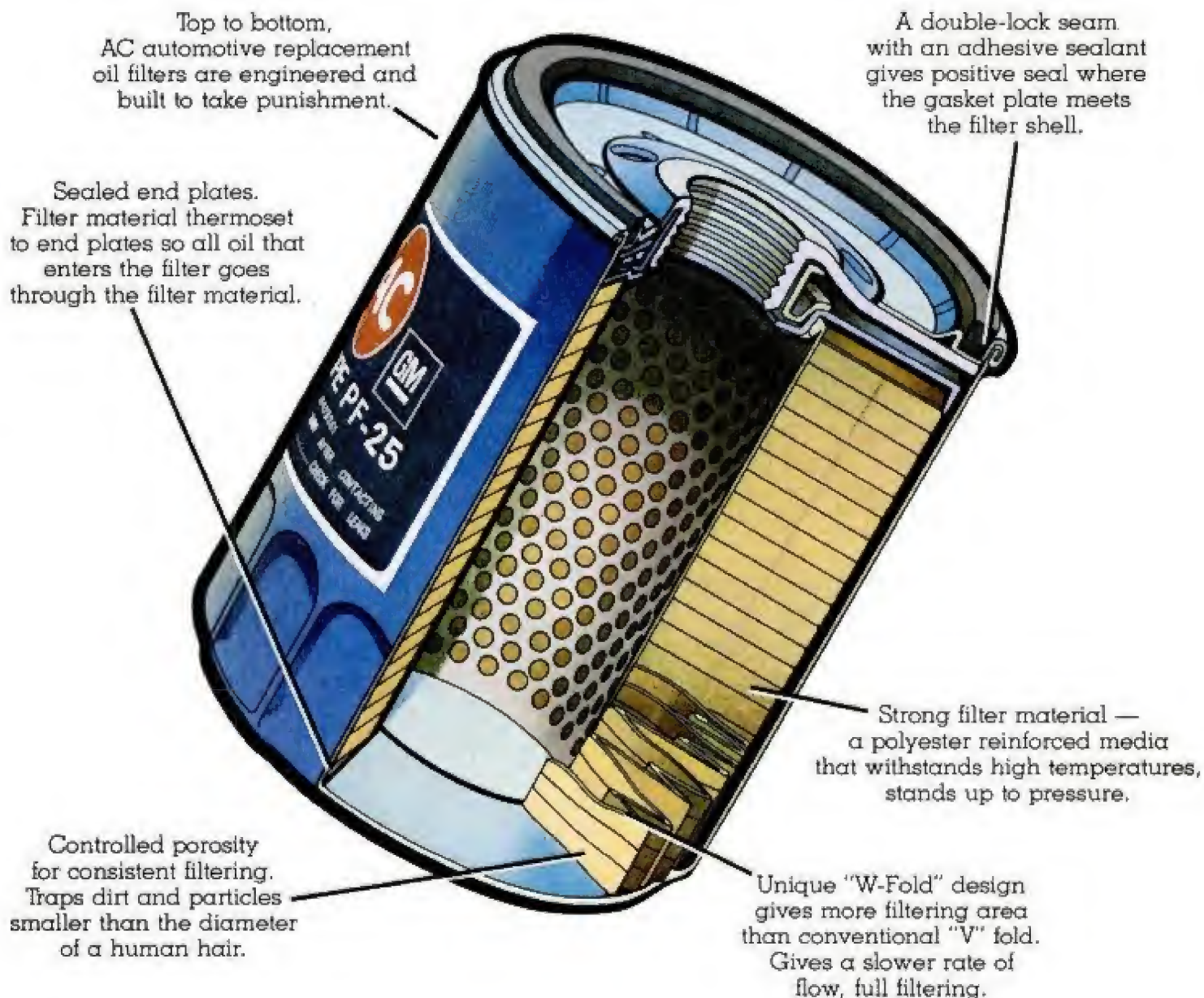
Next November, the ozone layer will be investigated systematically for the first time by a NASA satellite—Atmosphere Explorer-E (shown in the photo below). Put into a low



orbit, the satellite will take ozone readings at various locations around the globe. This information will be beamed back to Earth, processed by computers at Goddard Space Flight Center, and distributed to scientists at research facilities.

Meanwhile, S. C. Johnson & Son, Inc., America's largest producer of aerosol products, has announced that the wax company is ending the use of fluorocarbon propellants. Other gases that don't attack ozone will be substituted. ★ ★ ★

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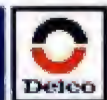
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And while we're on the subject of engine protection, we might offer this thought. You may be making fewer and shorter trips these days to conserve fuel. Unfortunately that can keep your engine from getting hot enough to burn off the condensation that forms in your crankcase. Condensation that when mixed with certain contaminants can form acid that can rob you of protection. So as recommended in your

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There's a bit of the Black Max in every Mercury.

The same standards of power and de-
pendability go into every 1976 Mercury
outboard—from the 4-hp trolling Merc® to
the awesome 175-hp Black Max.

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BLACK MAX

Mercury's new symbol for power and dependability.



Mercury Marine/Division of Brunswick Corporation.
Fond du Lac, Wisconsin/Canada/Australia/Belgium



A BRUNSWICK COMPANY





THE PM GARAGE



Inexpensive ramps

Anyone who's changed his own oil or lubed his car by hand has felt the need for ramps. Six years ago I got fed up with squeezing under my car or parking it halfway up a curb, and I did buy a pair of ramps—the cheapest J.C. Whitney offered. They cost \$14.95 then—about half the price of other ramps. Capacity was 3400 pounds—more than enough for the front or rear of any full-sized American car.

I've used those ramps literally hundreds of times, and never re-

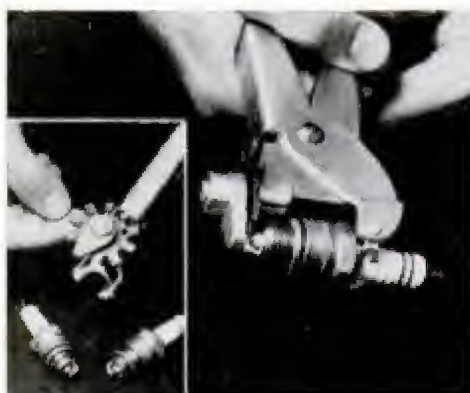


gretted the purchase. In fact, I've steadily congratulated myself for not buying a more expensive pair. In the latest Whitney catalog these ramps cost \$17.95, which I still consider a bargain. Write J.C. Whitney & Co., Box 8410, Chicago, Ill. 60680, and ask for Ramps No. 89-9370B.—M.L.

Sparkplug gapper

One of the more intriguing devices in the Brookstone Co. catalog of *Hard-To-Find Tools and Other Fine Things* is the sparkplug-gapping tool—"works precisely every time." That it does, but I wonder if, at \$7.50, it's something for the *Saturday Mechanic*. It's more like something for the man who has everything—except that he usually doesn't gap his own plugs!

I gapped my four plugs at .032 inch and then gapped my emergency



spares too. The tool is well suited for mass-production plug-gapping. As shown above, all you do to use it is rotate the gauge (which has 10 gaps, .018 to .035 inch) to select the gap, insert the plug in the jaws (the tool holds 10 and 14-mm plugs) and squeeze the handle a couple of times.

This well-made device saves the trial-and-error chore of bending and/or tapping the outer electrode. But only you can decide if you'd be better off buying \$7.50 worth of new plugs instead. Brookstone Co., Peterborough, N.H.—B.H.

Gabriel Hi Jackers

Gabriel's Hi Jackers are air-adjustable rear shock absorbers for cars and trucks. I've been anxious to try air shocks on my 1967 Camaro, whose single-leaf springs have always let the rear suspension bottom on grade crossings and medium-to-severe dips. Normal heavy-duty shocks haven't come close to curing the problem.



You install Hi Jackers like normal shocks, fit the tubing and plant the central air valve. All very simple, it took me about an hour, including testing for air leaks with soapy water.

The shocks I replaced were nearly new, heavy-duty, name-brand units. The Hi Jackers make the rear ride higher than before, even at 30 p.s.i. normal pressure. Maximum is 150 p.s.i., which raises the rear a good eight inches and increases load-carrying capacity tremendously.

I tried to bottom the suspension at 30 p.s.i. by driving over hard bumps, but the Hi Jackers kept the rear from bottoming. The car rides a bit more firmly now than before. The only aspect I question is Gabriel's warranty: 18 months or 18,000 miles. This seems a bit skimpy for the price. These particular Hi Jackers came to \$55.76 plus \$8.20 for the mandatory tubing, fittings and valve.

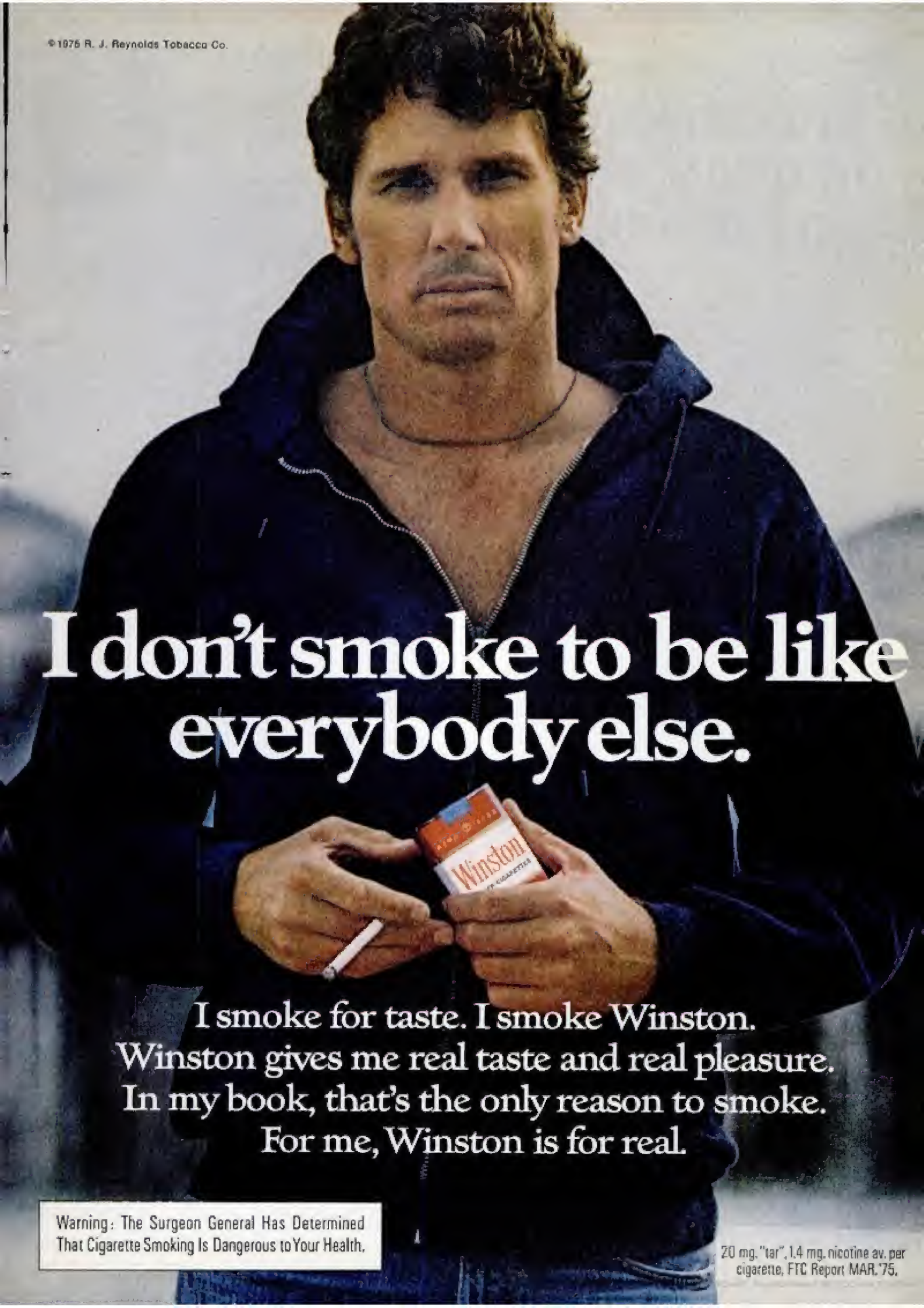
Hi Jackers are available at auto parts stores or directly from Maremont Corp., Gabriel Div., 200 East Randolph Dr., Chicago, Ill. 60601.

—M.L.

New timing light



I wish I owned a car that was good for 8000 rpm! Since I don't, I couldn't completely check out the Penske DC Inductive Timing Light which is supposed to be accurate up to that speed. What is marvelous about the timing light is the inductive clamp that does away with the fumbling with adapter and clips. With the clamp you pick up the spark to trigger the light with one simple squeeze. The light is nicely designed and put together and worth the \$40. It's at Sears Tire and Auto Centers or available through the catalog. Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684.—B.H.



I don't smoke to be like
everybody else.

I smoke for taste. I smoke Winston.
Winston gives me real taste and real pleasure.
In my book, that's the only reason to smoke.
For me, Winston is for real.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

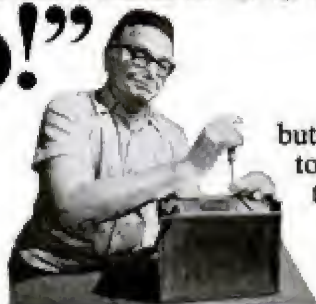
20 mg. "tar", 1.4 mg. nicotine av. per
cigarette, FTC Report MAR, '75.

Henry Morgan says:

"If I can learn to fix my own appliances... you can too!"

"I have 10 thumbs... five on each hand. So fixing appliances hasn't been one of my strong points. But I saw an ad that said they could teach me all I need to know... at home, in my spare time. I sent for the NRI catalog on their course in Servicing Electrical Appliances... and it looked like a pretty good deal. Now that I'm into the course, I can tell you this: it's the only thing I've ever sent away for that was even better than they said it was!"

Now I can thumb my nose at the repairman. I really can do it myself. Not just the toaster or mixer,



but the big stuff, too... like the washer, oven, even the lawn mower engine.

They give you everything you need. Bite-size lessons you can handle, with an experienced instructor ready if you need help. You even build the professional appliance tester that the pros use for trouble shooting and repairs.

The course is short, it doesn't cost very much, and you'll soon find yourself picking up spare time money doing repairs for other people. They even show you how to set up your own business, if you've a mind to.

Find out for yourself. Send for the free catalog. If I can do it, so can you."

Henry Morgan

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No Salesman will call

Please send me your free catalog "Servicing Electrical Appliances". 600-095

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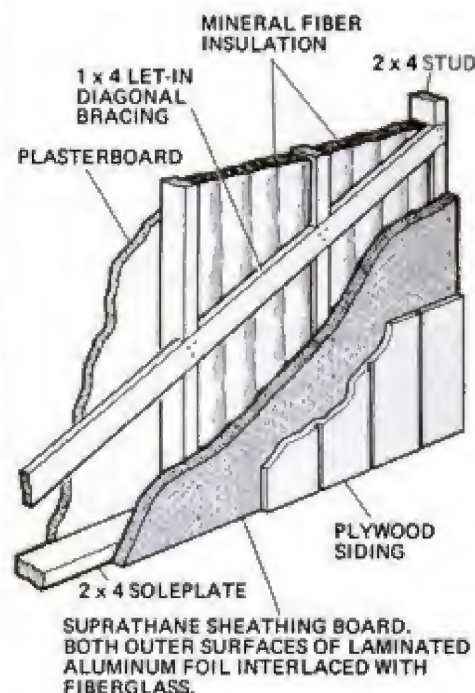
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3939 Wisconsin Avenue,
Washington, D.C. 20016

Accredited Member National Home Study Council

Sheathing that also insulates



Insulated sheathing is intended to cut down energy consumption in frame homes.



A revolutionary insulation board for use in place of plywood or other sheathing materials has been introduced by its joint makers, Rubicon Chemical and U.S. Mineral Products Co. of Stanhope, N.J. 07874. Called Suprathane, the laminate sheathing board (1¼-in.) consists of a closed-cell urethane foam sandwiched between glass-fiber reinforced aluminum-foil skins. Thermal tests made with the material installed on a wall section, as in the drawing above, resulted in an impressive "R" value of 22.7. (Current standards in the building industry are "R" 11 and 19 for walls and ceilings respectively.) Product distribution will be nationwide.

—Harry Wicks, Workshop Editor

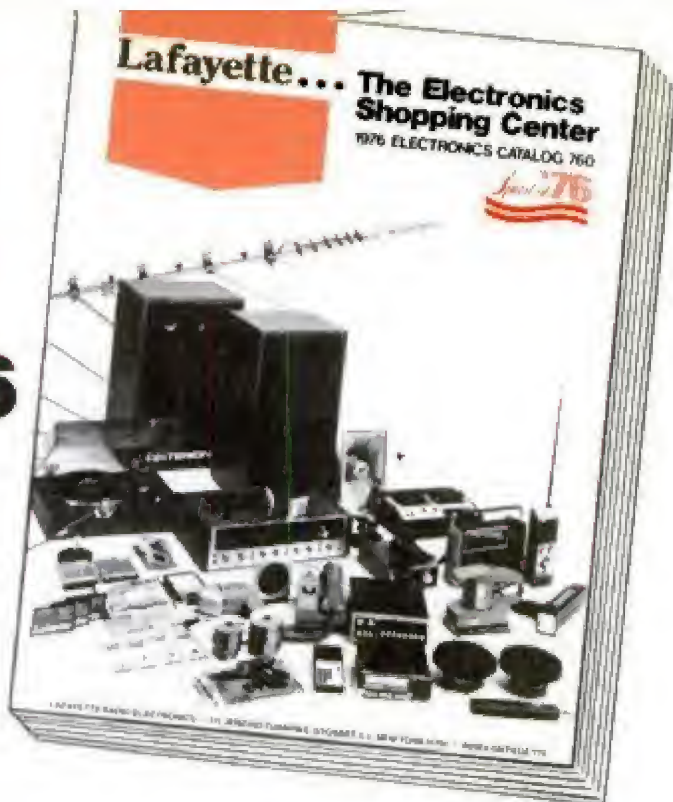
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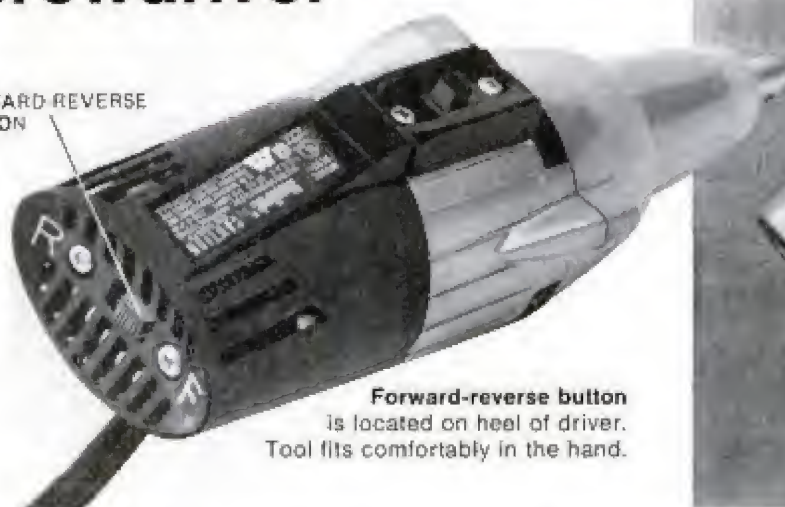
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Shopmate's electric screwdriver

FORWARD-REVERSE
BUTTON



Forward-reverse button
is located on heel of driver.
Tool fits comfortably in the hand.



OPERATING
BUTTON

SLOTTED BIT, FOR
SCREWS 7 TO 12

SLOTTED BIT
FOR SCREWS
4 TO 8

PUNCH

NO. 2 PHILLIPS BIT

Since inquiries about electric screwdrivers often cross my desk, I figure it's high time to report on a personal favorite: Shopmate, manufactured by McGraw-Edison. Its palm-fitting size and sleek looks belie this little beauty's power and torque. I've learned, for example, that it's impossible to stall the tool—your

wrist will give or the screwhead will snap first. The driver does take some getting used to: Because of all that power, there's a tendency to "walk off" the screw. You quickly learn to engage the bit in the slot before applying pressure to activate the bit rotation. Opinion: This is a *must-have* tool for active and involved

home handymen.—*Harry Wicks, Workshop Editor*

SPECIFICATIONS: Model 2810 Screwdriver

Motor: 2.0 amps., 220 rpm, 115 v.a.c. Weight: 3 lbs. Chuck accepts 1/4-in. shank. Positive clutch. Capacity: Nos. 4 through 12 screws and 1/4-in. machine screws. 100:1 planetary gear reduction. Price: \$26.31. Manufacturer: Shopmate, McGraw-Edison Co., Parkade Plaza, 601 Business Loop 70 West, Columbia, Mo. 65201.

Dutch Boy® Latex Stain beats oil stains two ways.

Protects longer.

At the Dutch Boy testing fields oil stain and Dutch Boy Latex Stain had a duel in the sun, wind, and freezing cold for 3 years. Look at the pictures of the actual boards and judge the results for yourself.

As you can see, the oil stain has faded and left the wood exposed in several spots.

Meanwhile Dutch Boy is still giving good protection. And the colors are rich and strong.

Cleans up easier.

If you've ever used oil stain we don't have to tell you how hard it is to clean up.

With Dutch Boy, on the other hand, all you need is water. Dutch Boy Latex Stain. Protects longer. Cleans up easier.



Dutch Boy Latex Stain

Oil Stain



Dutch Boy Paints
Division of **NL**
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ALL OUTDOORS

WITH BILL McKEOWN



National Hunting & Fishing Day

Once a year sportsmen have a chance to explain to friends (and even enemies) what the appeal of outdoor action is all about. This year it will be Saturday, Sept. 27. All over the country fishermen, shooters, campers, hunters, hikers, archers, boatmen, backpackers—anyone, in fact, who enjoys fun afield—will find demonstrations and displays scheduled to show the variety of pleasures available across our lakes and hills. During the past three years an estimated 45,000,000 people have attended National Hunting & Fishing Day open-house activities sponsored by 3000 clubs in all 50 states. Local, state and national legislatures have set the day aside for observance, and country-wide conservation organizations endorse the displays.

Probably one of the most worthwhile results of the day is the recognition it gives outdoorsmen as the people who not only encourage conservation but pay for it. Over \$2.5 billion from hunting and fishing licenses, excise taxes and permits has been poured in so far, with about \$165 million added every year.

Guides for clubs and individual sportsmen planning demonstrations and displays are available at \$3 from the NHF Day Committee, 1075 Post Road, Riverside, Conn. 06878. The committee also offers bumper stickers at five for \$1.

Target totals

The new record is 4000 shots fired in one day by each man on a trap team, and it was set by a Massachusetts squad of six shooters for a score of .9750. Shattering all but 600 of their 24,000 clay targets, they set a record that topped a previous total of 15,000 by a five-man team sponsored by the Garcia Corp. at Oak Grove, La., last year.

The Bay State team, firing at the Singletary Rod & Gun Club, Oxford, Mass., took 13 hours, 37 minutes and used regular production-run, full-choke Winchester 12-gauge Super-X Model 1 autoloaders with 30-inch barrels and Winchester-Western Double A trap loads, all made by the sponsoring Winchester-Western Div. of Olin Corp. Each member of the team of three left-handers and three right-hand shooters used the same

gun throughout and no malfunctions of any kind occurred.

High scorer William Anzaldi, 29, had straight runs of 484 and 470, broke 2957 of his first 3000 targets for a .9857 average and finished with 3947 hits out of 4000 for .9867. Overall, the team of six had 39 runs of 100 or more straight, and their record of breaks will be hard to break.

RV rider report

What do recreational vehicle owners like—and dislike—about their rigs? We asked retired automotive engineer Bill Kellas to survey RV owners for their performance ratings during a recent 8000-mile tour of the U.S. Kellas had previously used camping trailers for various cross-country trips. This time he and his wife selected Apache's solid-state Mesa and found it an excellent choice.

RV appliances, he reports, are a major problem. Some owners are not used to servicing stoves, refrigerators, plumbing lines, LP furnaces and water heaters. Initial installation kinks often had to be corrected by the owner along the way. Typical troubles: an icebox drain with twisted hose line, storage cabinet doors that swing open while the rig is rolling along, water heaters installed so that extra long matches are necessary to light them, removable tables with nonrecessed floor-flange mounts that cause continual tripping.

Many owners reported that their tow-away problems had been quickly solved with the installation of a load-equalizing hitch. Every trailer, pickup and motor home camper with an LP tank but no gas-level gauge mentioned it as the next accessory he wanted to buy. Cheap RV construction was an occasional complaint. Quality, it seems, is worth shopping and paying for on and off the road.

For anglers on the go

Really great gear—a fine camera, rod and reel, boat, rifle, recreational vehicle, pipe, trap gun, knife, pair of boots, wet suit, backpack and tent—is a special pleasure to own. Possibly

next best is to admire the favorites of other outdoorsmen—Teddy Roosevelt's favorite saddle gun, perhaps, or Zane Grey's marlin reel—and anglers driving the Northeast are in luck.

Near Binghamton and Syracuse, N.Y., and not too far from baseball's Hall of Fame at Cooperstown, the Gladding International Sport Fishing Museum, South Otselic, N.Y., offers a look at handsome antique rods and reels, lures and paintings, catalogs and books, displayed in a fine old Victorian mansion with trout streams nearby.

Fly fanatics will want to see famous early items from this specialized sport at the Museum of American Fly Fishing in Manchester, Vt., adjacent to the Orvis Co. and the well-stocked streams in the rolling Green Mountains. Admission to both museums is free, but it is well to write or call ahead for exact visiting hours, (plus dates of the trout season).

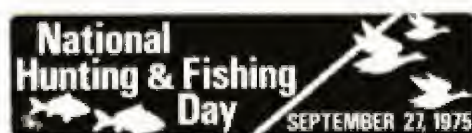
Parking permitted

A system to protect fragile back-country areas in the national parks seems to be successful so far. Free permits are now being required for backpacking into campsites accessible by trail only at 34 parks. Advance reservations have been required at Grand Canyon National Park in Arizona, but all other parks have provided permits on a first come, first served basis. Developed campgrounds which can be reached by car have not been affected.

Last year, when 23 parks offered the system, over two million camper-days of use set a new record, and comment from many backpackers has been favorable. Ecological damage has been reduced, and the more programmed use of unimproved sites has resulted in more of the peace and solitude that is the back-country backpacker's goal.

Scouting Scouts

New from International Harvester for 1976 are the Scout Terra—a 118-in.-wheelbase sport pickup in between the mini imports and standard makes; the Scout Traveler—a hatchback station wagon; the Scout II offroader—a 100-in.-wheelbase machine with 10-in. tires and a roll bar. And IH is first to offer a small diesel (92-hp) in light trucks. ★★



Monro-matic® Shock Absorbers.

You'll feel the difference with your head, your hands and the seat of your pants.



Your shocks can get worn after a mere 20,000 miles. You might want to replace them with something a lot more reliable. A shock more people rely on than any other. The #1 shock in the world. Monro-Matic.

Your head judges.

More professional mechanics install Monro-Matic than any other shock in the world. Doesn't it seem logical that people who know the most about shocks would install the best ones? Point Two: Every Monro-Matic comes with a Lifetime Guarantee. A guarantee that's good for as long as you own your car. Only installation is extra. Point Three: Monro-Matics are designed to handle the increased demands radial tires put on your suspension. Because Monro-Matics handle radials easily, think how well they'll handle bias-plys.

Your hands can tell.

When you turn the steering wheel to take a tough corner, you'll feel the difference. You won't have to keep over-correcting.



Because our shock adjusts to the road automatically. Instantly. The technical reason our shock reacts so quickly is the special 6-valve stages inside. In personal terms, it means you get flatter, truer

The seat-of-your-pants test.



With Monro-Matics, you'll feel an immediate improvement in com-



fort. A big difference, not a tiny one. You'll feel less road vibration and more stability. In fast stops. Over mammoth bumps. Or hairy potholes.

Monro-Matics. When you've got a better shock absorber under your car, you'll feel the difference inside your car.

cornering.
Less wheelhop.
More precise handling, added control, and a little peace of mind.

First in shocks.



You'll feel the difference.

STOP YOUR CAR FROM
LEAKING OIL! GET



BEARIN' SEAL



Stops oil leaks in front and rear main bearing seals. Add to crankcase oil. Mixes with all motor oils... stops oil drip and waste.



In Bottles or Cans

TRANS-MEDIC

Before you have your transmission overhauled... try Trans-Medic! It may save you over \$150.00 in repair costs! Eliminates slippage and downshifting.



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Regular (No. 1), the super-penetrant that loosens rusted nuts, bolts and parts... in seconds!



LIQUID WRENCH

New (No. 2) stops squeaks, cleans and lubricates... protects metal tools, parts. Dries wet engines... protects against rust and corrosion.



For Really Dirty Hands, Get

LAN-LIN

Rub on... rinse or wipe off! Quickly removes dirt, grime, grease and paint.

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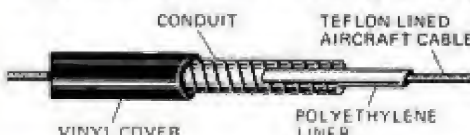
THE BICYCLE SHOP

GENE LOOKS AT NEW PRODUCTS THIS MONTH



For easier braking, shifting

Ordinary brake and derailleur cables can work hard when cable tubing is at an extreme angle or grease dries out. Now you can shift or brake, even if the tubing is tied in knots, with a



new "Ultra-Glide" self-lubricating cable and tubing. \$3 for a brake set, \$2.50 for derailleur set, from bike stores. Made by Wescon Products Co., Wichita, Kans. 67201.

Don't walk back

If you're caught without a spare tube or patch kit and pump, you can still "patch" the tube in seconds—"Safety-Zone" sealer and inflator seals most punctures. The pressurized can screws down onto a valve to shoot in sealant and reinflate a tube. This product can be used on tubular-tire Presta valves with valve adapter to fit U.S. Schraeder valves. From Pennsylvania Petroleum Products Co., Philadelphia, Pa. 19148 and your bike shop.

Roller riding any time

The next best thing to outdoor cycling is riding the rollers indoors. Weyless rollers (spotlighted below) are so quiet that you can pedal your way to health while watching television. They improve street cycling efficiency by teaching you how to ride without energy-wasting extra body motion. Price of about \$165 includes



both speedometer and steps; available from your bicycle shop.

Let 'em know you're there

A really powerful, light and compact Freon horn with a handlebar-mounted holder gives up to 200 blasts from a replaceable can. Horn and can cost \$4.95, refills \$3.50 from most bike stores. Made by Falcon Safety Products, Inc.

Light as a feather

What's light as a feather, stiffer than steel, yet absorbs fatiguing road shock? It's the new graphite-bonded-to-metal 1.9 kg. steel-lugged frame made by Composite Sports, Inc., 3250 Wing St., San Diego, Calif. 92110. Frame less fork weighs only 3 lbs.



The manufacturer sells frame and fork only for \$500; you add all the other parts to get a road bike weighing around 18 lbs.

Sealing your rear derailleurs

There are sealed bearing hubs and bottom brackets on the market. Now you can also buy sealed-bearing rear derailleur wheels to fit Campagnolo derailleurs for around \$4.50 a pair from Durham Bicycles, 3944 Marathon St., Los Angeles, Calif. 90029.

Don't bite dogs

Dogs chase bicyclists, sometimes bite them or get under wheels and knock over bike and cyclist. If you can't outrun a dog, divert its attention with a harmless chemical spray. Best I have found is "Paralyzer" in a 5-in. spray can that sends a jet of chemical about 15 ft., stops the biggest, meanest police dog in its tracks. \$6.95 from Nicholas Industries, 7407 North Wolcott, Chicago, Ill. 60626. Not sold to minors. ★★

Sandwich studding gets more lumber from the tree



Traditional framing lumber may have met its match. The federal government has developed an artificial 2x4 that outperforms the real thing and costs less. But the surprising advantage of Com-Ply composite studding is that it means each log produces twice as much usable lumber as if sawn conventionally.

The principle behind Com-Ply is the same as that used in some furniture. Particles of wood and bark are bonded together with a synthetic resin to make a tough particleboard core, which is then faced with two or three layers of 1/10 or 1/8-in. solid-wood veneer on the narrow (1½ in.) sides. Com-Ply puts the strongest parts of the log where strength is needed, and the result is a stud that stays straighter than a regular 2x4; equals its load-carrying capacity, and holds nails better. In test houses, Com-Ply has been handled just like conventional studding.

By turning all of the log into high-value lumber, Com-Ply promises more efficient use of our forest resources.
—Stephen Walton



The proud smoke.

Today's L&M... Rich, mellow, distinctively smooth. Blended for today's taste with a tradition of over 100 years of tobacco experience. It's a matter of pride.

Proud tradition. Proud heritage. Proud taste.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

The 'computer' you put in your mouth

You slip a small plastic stick in your mouth, wait a few seconds, then pull it out. Recorded on the end is your body temperature. After noting the reading, you throw the stick away—yes, *throw it away*. You've just taken your temperature with the world's first *disposable* thermometer.

This remarkable device is the result of years of research into new forms of data processing. About the size of a tongue depressor, the discardable thermometer is the development of Bio-Medical Sciences, Inc. (BMS) of Fairfield, N.J. While most data-processing systems are electronic, what's unique about this one is that it's *chemical*.

Imbedded in the end of the thin, flat plastic stick is a series of different chemical crystals arranged in rows of "dots." Each chemical is chosen for its ability to melt or "fire" at a precise, specific temperature. The crystals provide a range of melting points from 96° F. to 104.8° F. in .2° increments. The dots fire sequentially as they react to heat in a patient's mouth until the highest temperature is reached. Thus you "read" the results merely by noting the position of the last dot to fire. If the dot is in the row marked 98 and the column marked .6, then the temperature is 98.6° F. This is the reading shown in the photo at left.

The BMS thermometer functions, in effect, as a simple chemical "computer" with an almost instantaneous readout. Arriving at its final design, however, was not as simple as the basic concept may seem. What if the thermometers were stored in a sweltering warehouse or cargo hold? The chemical crystals would melt and the thermometers become useless. Some means had to be found to keep the crystals from firing prematurely. At the same time, another means had to be found to make the tiny chemical dots clearly visible when they did fire.

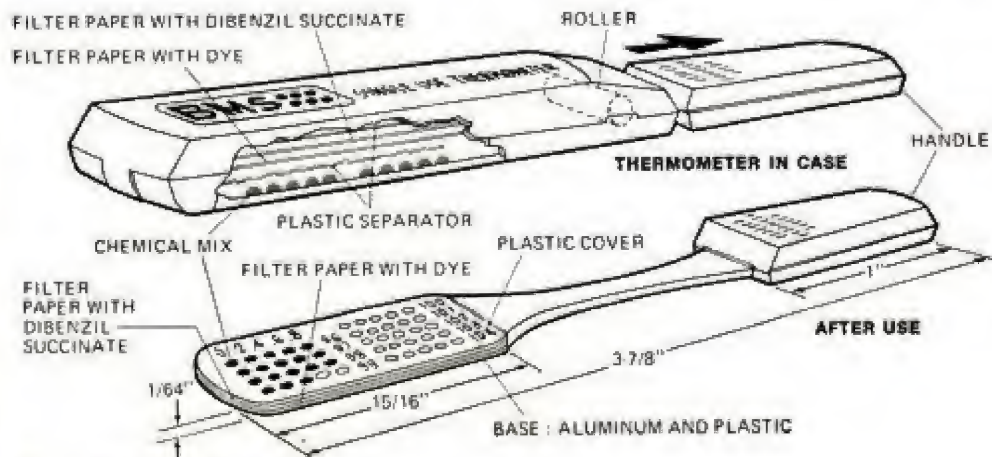
Both problems were solved through clever engineering. First, a protective plastic separator strip was placed over the dots. Then a dye-impreg-

nated paper strip was added on top. Before use, the thermometer is kept sealed in a plastic case. To use it, you break the seal and pull out the handle. This automatically withdraws the separator strip, and a roller presses the dye strip firmly into contact with the dot pattern. As the dots melt, they soak into the dye and turn from white to blue, making them easily readable. Even if the dots melt before use, they can't produce a readout so long as the protective separator is in place, keeping them from touching the dye. They simply recrystallize as they cool and return to their original form with no damage to the thermometer.

Why a disposable thermometer when other types are so readily reusable? BMS studies turned up a surprising fact: It costs hospitals 24 cents just to resterilize and store the conventional mercury-glass thermometer after each use. And some 10 million temperature readings are made daily in the U.S. alone. At a dime apiece, the BMS disposable thus makes good economic sense. Moreover, tests show it to be more accurate than the glass or even the newer electronic types.

It has other advantages, too. It can be read in about 30 seconds compared to the three to four minutes required for the glass type, saving nurses valuable time. It's safe in the mouths of children and semiconscious patients who frequently bite and break the glass type. And it's ideal for carrying on trips or in a doctor's bag since there's no danger of breakage or need to bother with resterilizing a conventional thermometer.

At the moment, BMS is selling its disposables only to hospitals, but plans to make them available to pharmacies for home use. Other possible applications of the chemical computer include such exotic devices as disposable meat thermometers and various warning indicators that signal when food has gone bad or medical equipment has become unsterilized. ★★★



ONE FOR EVERY CAR.

Pennzoil has motor oils to protect all kinds of cars in all kinds of weather. And now there's Pennzoil 20W-50, the newest member of the multi-viscosity family. Pennzoil 20W-50 fulfills the need created by the latest generation of today's automobile engines, and is specifically formulated to protect these hotter running engines.

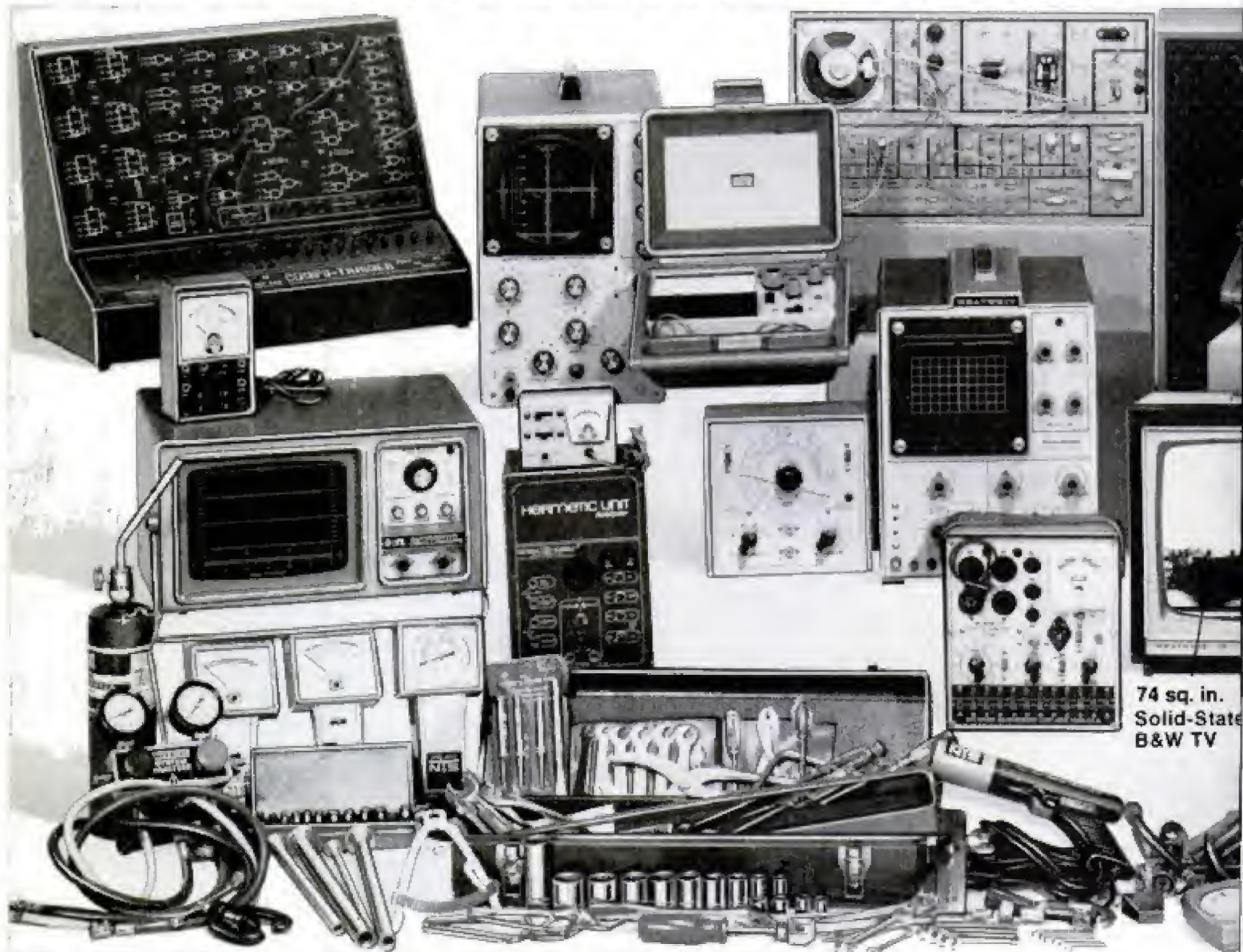


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DETROIT LISTENING POST



BY ROBERT LUND

Ford mini to be multinational

Ford is still checking out the options on a car to counter Chevrolet's mini (which will be called the Chevette and be seen in next month's PM). They can build it here, in Spain, in France or in all three countries. Regardless of where the pieces are put together, the car will be for the world market, not just for the United States, so it would make sense to have assembly plants in more than one country. One decision that has been nailed down: The car will have front-wheel drive.

Minis aimed at world market

All new mini cars out of Detroit for the foreseeable future will be world cars. The Chevy Chevette is basically the same car GM has been building overseas—in England, Brazil and Germany—for several years. The company already has plans to put the same car in production in Australia and Japan. The small car that Chrysler is considering is the French Simca with skin and mechanical changes. Now Ford is going the same route. The only precinct that hasn't been heard from is American Motors.

The bigger U.S. cars, which have never sold well overseas, will continue to be built for American tastes and the American market. But all new small jobs will be global cars. Detroit has to get more stretch out of the dollars it puts in tooling. The world car is one way of doing that.

New setback for Wankel

The troubled rotary engine is going to be in even more trouble with the launch of Chevrolet's Chevette. The best mileage GM has been able to coax out of its version of the Wankel while complying with regulations on emissions is something around 20 miles to the gallon. Actually a little less than 20 mpg. The 85-cubic-incher Chevrolet will use in its smallest-ever car will beat the rotary on mpg by 100 percent. And it will run much cleaner than the rotary.

That leaves the Wankel with only one advantage—it takes fewer parts to build. But there would be no point in building it if it's a dirtier engine than the conventional piston engine, and if it can't match a standard engine on mileage. It would be prema-

ture to write the rotary off as a dead duck, but it's going to take a lot of surgery to resuscitate it.

Vega, Pinto winding down?

The small Chevrolet will have repercussions elsewhere. Ford is developing a four-cylinder, 1.4-liter engine that will be a twin brother to the Chevy engine.

The Chevrolet mini also raises a question about the future of Vega, a subject GM doesn't like to discuss. Vega isn't in imminent danger of getting the ax—it will be around next year and the year after. But where will Vega fit in after GM completes re-sizing its cars in '77 and '78? After the "revolution," Vega will be too big to be called a subcompact and too small to qualify as a compact. Not only in terms of size, but in selling price. With the '76 model, Vega will be going into its sixth year. GM has earned back its investment in tooling the car and it's time Vega was retooled or retired.

You can put ditto marks after the previous paragraph and apply it to Pinto. Except that Ford doesn't yet have a smaller car to replace Pinto.

Subaru to match Chevy on mpg

Chevrolet has been getting a lot of free ink out of reports that its little car is expected to get 40 mpg on the highways. While no other U.S.-made car will be able to match that mileage, Chevy will have to share the glory with an import. Subaru has a car coming late this summer that will give the same mileage.

More lean burns from Chrysler

Chrysler is working up four and six-cylinder versions of its lean-burn engine. It hasn't confirmed this officially, but did tip its hand indirectly. Its lean burn will be limited to the big V8s—400 and 440 c.i.d.—on '76 cars. If the government doesn't change the regulations on emissions, Chrysler says it will go lean burn on all cars a year from now. "All cars" would have to include Fours and Sixes.

A vice president of Ford told me Ford is interested in the lean-burn approach "used in combination with both a thermactor and a reactor." But that's as much as he'd say.

Detroit deflates air bag

Although the fate of the air bag is still being argued—with Detroit "against" and the government "for"—the car companies have pulled together estimates of what it would cost to replace an air bag after the original equipment unit was deployed. The estimates average \$500 to \$600, and Chrysler says replacement cost could run as high as \$900. Compare those prices against the price of new tires. You can buy first-quality radials for something less than \$200 a set. Even so, millions of motorists drive around on unsafe tires. If people won't spend \$200 to replace worn tires, who would shell out \$500 to replace an air bag?

That's not to say air bags aren't a good idea. But you can't force-feed people to buy stuff they don't want, unless you make it mandatory by government decree.

GM, the only automaker to give air bags a fair shake on a take-it-or-leave-it basis, recently shifted from a pro-bag position to an anti position. GM offered bags as an option on '74 and '75 models of its big cars. If anyone has money to spend on air bags, it's buyers of the big Caddies, Buicks and Olds. During the two years GM offered the item, it sold something less than 8000 units. The company was tooled up to produce 100,000 bags the first year. That means GM has the makings for 92,000 bags stashed away some place. That's a lot of crow to consume, even for a company the size of GM.

Next price hike Jan. 1

If you're thinking of buying a '76 car, you might want to get the order in before January to beat another price increase. A new government standard on rear brakes takes effect Jan. 1. Some companies will apparently install the brakes at the start of the '76 model run and cover the price hike when they announce '76 prices. Other firms will hold off on the brakes until the first of the year and up prices then. Ask the dealer if the car you're interested in has disc brakes or larger drum brakes on the rear. If he says "yes," the price of the car won't be increased Jan. 1. If he says "no," the price will probably go up.

★ ★ ★

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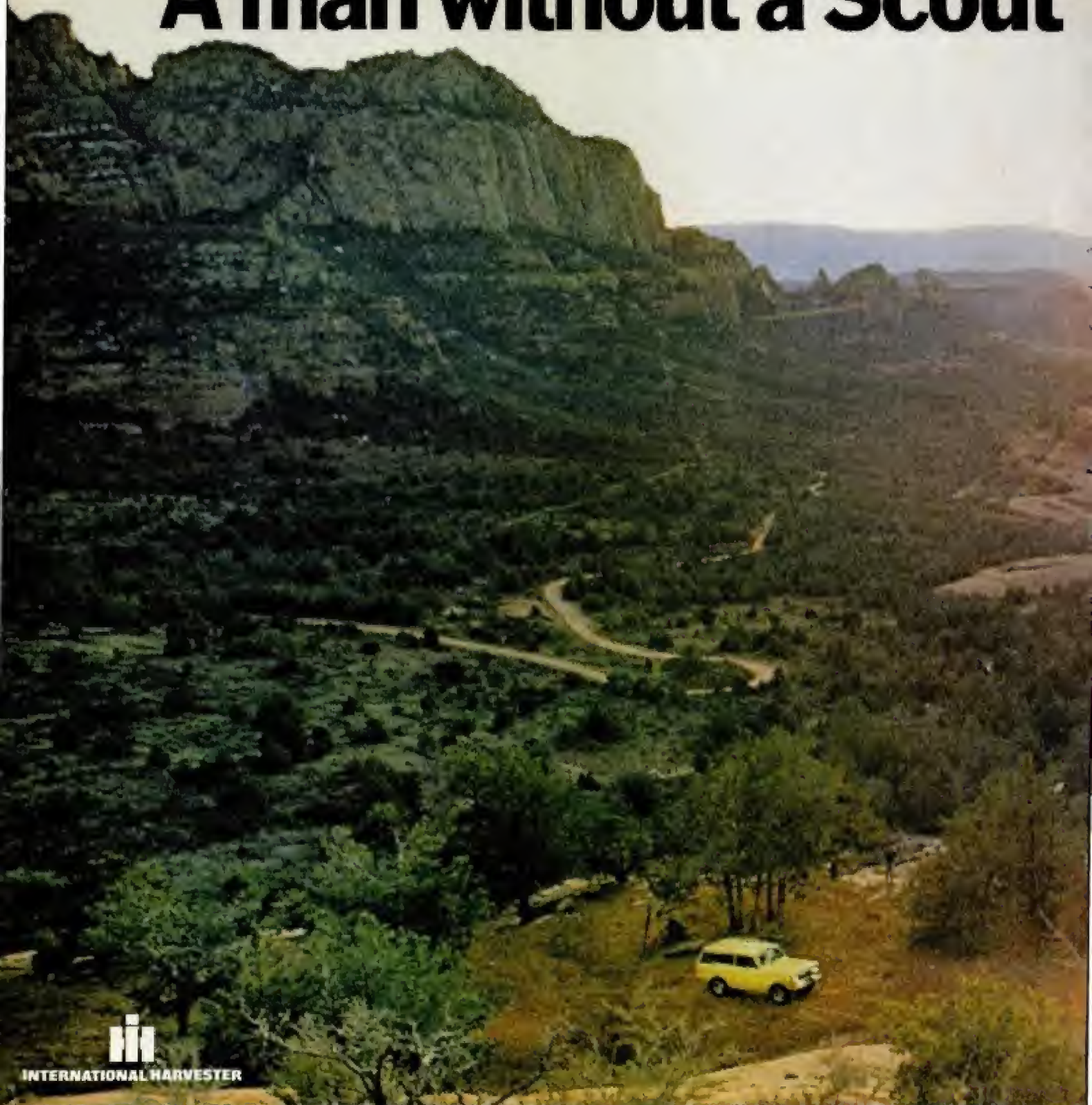
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QUESTIONS ANSWERED BY W. CLYDE LAMMEY

HOMEOWNERS' CLINIC



Year-round heat

I'm considering the installation of a year-round heating system in my vacation home. The home will be opened mainly on weekends, but I have the problem of year-round maintenance of sufficient heat in the place to prevent deterioration of the structure and freezing in the colder months. What heating system can you recommend?—David Seinfeld, Brooklyn, N.Y.

If the cost of electricity were no object, electric radiant heat would be most desirable. This would eliminate the problems of antifreeze in a hot-water system, deterioration owing to lack of heat and possible concern about continued operation of the system in your absence, and would provide a reliable minimum temperature throughout the cold months.

My second choice would be gas-fired warm-air heating, which could be planned for central airconditioning as well, to be installed at the same time or later. Hydronic (steam or hot-water) heat would be cheapest, if piping could be run in easily.

That old red stain

I've made a reproduction of an old pine chest and I can't find a stain that will reproduce that old red finish. Commercial stains I've tried on test pieces just won't do it. Do you have a suggestion?—M. Lyon, Burlington, Vt.

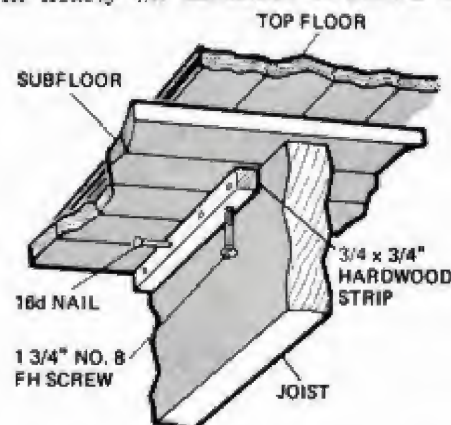
I once stained a similar piece simply by thinning artist's oil paints, using the lighter reds combined to get a tone that suits the requirements for this old finish. You must experiment in mixing colors and in thinning to a staining consistency. If it's too thin, you get a splotchy coloring; too thick, an ordinary paint job. Thin the color as it comes from the tube with turpentine and a few drops of artist's linseed oil and see how this will look on test panels until you get the desired color. Then apply as a stain and allow plenty of time for drying before applying any final finish coating.

Quiet that floor

Every time we move, the floors squeak underfoot. I have a full basement, can reach the floor from under-

neath, but what can I do to stop the squeaks?—Paul Hanlan, Detroit

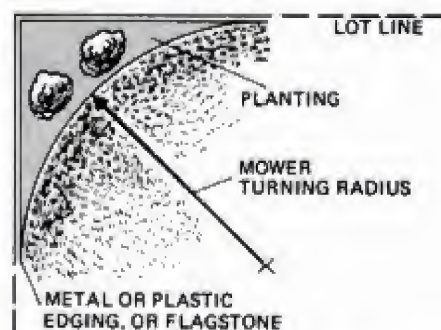
One way that seems to be effective in nearly all instances is shown in



the illustration above. First, locate the squeaks from the basement by having someone walk about on the floor. Then nail strips to the joists, spanning the areas of the squeaks, and making sure that the strips are pressed tightly against the floor as you nail them in place. Then have someone stand on the spot while you drive screws through the strips, through the subfloor and into, but not through, the top floor.

Landscaping problem

I have rectangular lawn areas in front and in back of my home. I've purchased a riding mower and I have the problem of maneuvering to get those square corners. Can you suggest a simple landscaping that will eliminate, or at least reduce, the cramping and angling of the mower, so I can do the job without stopping?—Fred Ewell, Emporia, Kans.



Although most of the newer mowers permit a fairly tight-radius turn when cornering, I've seen a landscaping arrangement that allows the

(Please turn to page 136)

Just like Dad's...

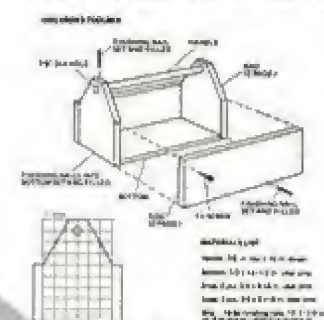
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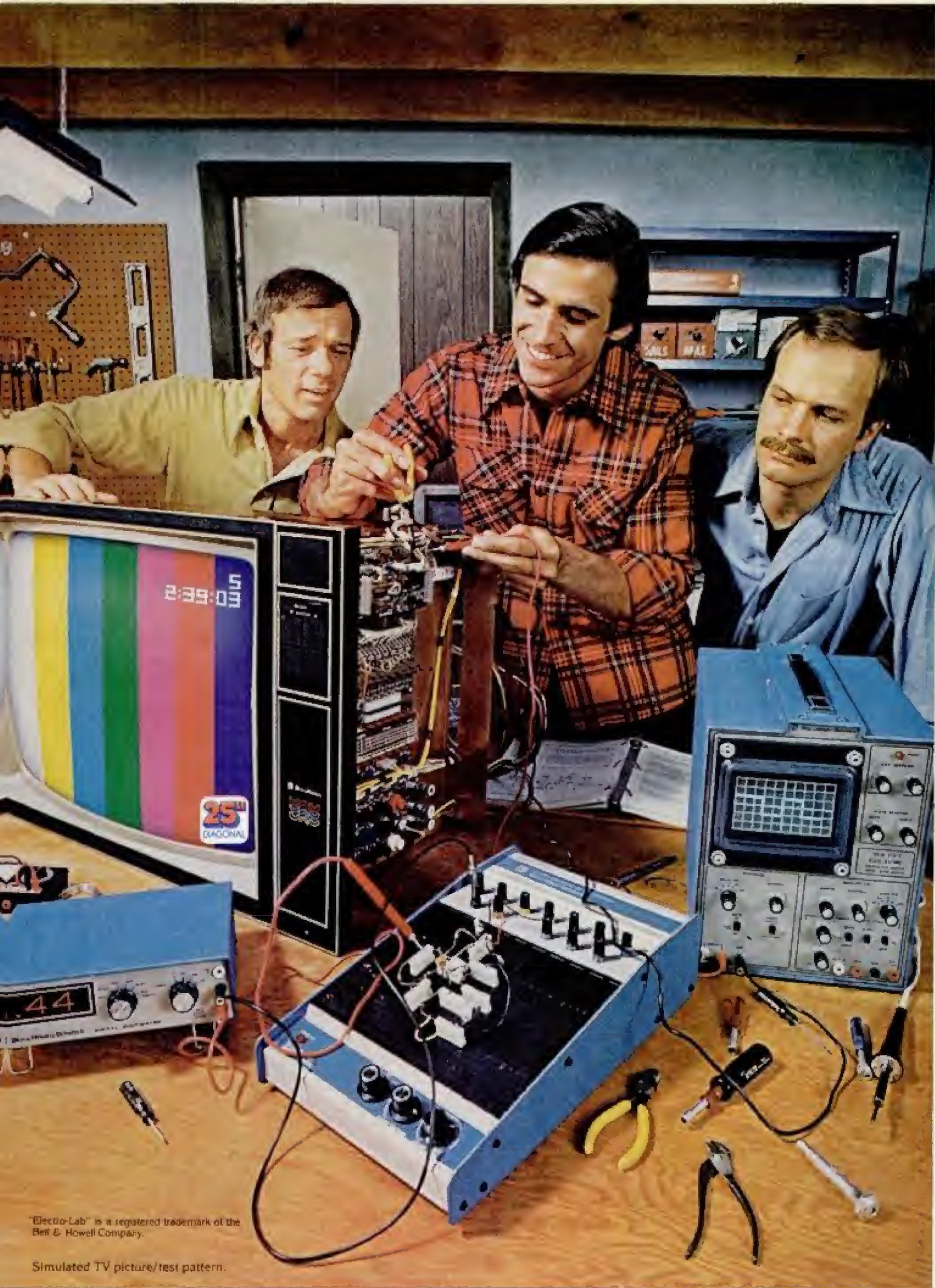
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CAR CLINIC

BY MORT SCHULTZ



Lifter noise isn't normal

My 1974 Plymouth with 318-cu.-in. engine has 5000 miles on it and has had lifter noise on cold starts since mile one. The noise lasts for a minute or two and occurs about 6 starts in 10. The dealer says it's normal. Do you think so? Should it be repaired?
—Darrel Neely, Omaha, Neb.

No—lifter noise which lasts for a minute or two is not normal; yes—it should be fixed. The lifter (or lifters) may have a mild bleed-down condition now, but will never get better and will probably get a lot worse. It might give up the ghost just as your warranty expires. Get it fixed!

Fuel injection hijinks

My 1971 Volkswagen 411 with fuel injection is giving me hard-starting problems. It's had many tune-ups, but the condition prevails and when the car finally does start, it looks as if someone dropped a smoke bomb out the tailpipe. I follow owner's manual starting instructions and I've been told there is nothing wrong with the car. But it doesn't start right. Can you help me?—A.E. Bawler, Mohawk, N.Y.

There may be nothing wrong with the car, but the same can't be said for the fuel injection system. To me it seems that too much fuel is being fed the cylinders. The trouble might also be caused by a problem in the ignition system, but after "many tune-ups" I should hope that any ignition failure would have been found and corrected, such as improper ignition timing.

Several areas of the fuel injection system could be malfunctioning. The important point is that you must take your car to a shop which has Bosch fuel injection analytical equipment and a mechanic who knows what he's doing. Any mechanic won't do—as your experience proves.

Some things the mechanic will look for include high fuel-pump pressure; dirt on the lower (injector) points in the distributor (which control injector opening and closing) that may be allowing injectors to stay open too long; and faulty pressure and temperature cylinder-head sensors.

It is also important to make sure excess fuel has not gotten past the rings into the crankcase, diluting the

oil. Pull the oil dipstick and see if the oil level is above the FULL mark. If fuel has gotten into the crankcase, drain oil and flush the crankcase.

Misplaced mileage

While looking for a used car, I was warned to beware of odometers having misaligned numbers—that this indicates mileage has been set back. This discouraged me from buying a 1973 Torino—a really sharp-looking car—from a Ford dealer. The car's odometer showed 20,123.3 miles, but the second 2 was out of line with the other numbers.

The salesman told me that even new cars have numbers that are badly out of line, and that this is no indication of a turn-back. Would you please set the record straight? Is it or is it not possible that this car had the odometer set back in spite of the law?—Ken Sullivan, Congers, N.Y.

Is it possible? Sure—anything is. But misaligned numbers on the odometer are no indication. The salesman is right.

However, this I'll tell you: Any dealer who takes a chance and turns back odometers is taking a big risk. As you indicated, Federal law prohibits anyone from setting back or otherwise tampering with an odometer. In the most famous case to date, a superior court jury in Baltimore awarded damages totaling \$32,000 to a woman who claimed she had been sold a used car on which the odometer had been turned backward.

If you have any doubt in your mind concerning the dealer's integrity, why patronize him? But say you do buy a car you eventually believe has been misrepresented. What should you do?

Get in touch with the consumer affairs department of your state government and request an investigation. An officer might have you take the unit from the car for an examination that can show indications of a turn-back.

Can't get service

Before it reached the 17,000-mile mark, my 1973 Chevrolet Monte Carlo developed a clunk in the driveline. The noise starts at about 35 mph and prevails as I coast to a stop

or let up on the accelerator in traffic. It is audible in either DRIVE or NEUTRAL. I have new tires, and the brakes have been inspected. When I asked my dealer to drop the drive-shaft and check universal joints, he told me the shaft on my car cannot be serviced. Your advice would be appreciated.—K.W. Brown, LaMirada, Calif.

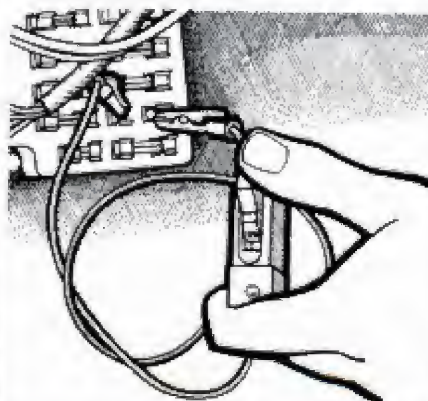
Are you sure you're driving a Chevy? Or is it that the dealer isn't a Chevy dealer? I know of no drive-shaft on a 1973 Monte Carlo that cannot be serviced. True, there are two designs—the Cleveland and the Saginaw—and before he begins service the mechanic must determine which one he's dealing with, because procedures differ. The Cleveland has snap rings retaining the universal joints, while the Saginaw has no

(Please turn to page 44)

Short check

Suppose a short develops in your car's electrical system and blows a fuse. How can you trace it—since a new fuse would probably blow before you could begin to find the trouble? Without a live circuit, it's hard to find a short.

Well, Champion Spark Plug Co. offers this idea. Attach two short wire leads to the terminals of a low-amp. circuit breaker, which you can buy in a hardware store. Use alligator clips and clip leads to the fuse holder of the blown fuse. This homemade device will pop off and on as you trace the short. After you've located and fixed the trouble, install a new fuse.



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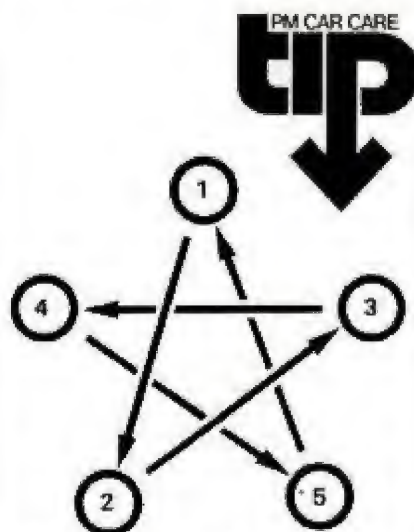
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CAR CLINIC

(Continued from page 42)

snap rings, which may be what is making the dealer think that service cannot be done.

Repair kits are available for both designs. To take apart the Cleveland-type universal joint, snap rings are removed. The lower bearing caps of the Saginaw-type universal joint must be pressed out. Once either kind of U-joint is apart, the parts should be inspected and replacements



Changing wheels

When you rotate tires or change a flat, do you give thought to the proper way in which wheel nuts should be tightened? If nuts are left loose, wheel movement can result, nuts and nut seats can become distorted, and eventually the wheel can fall. If nuts are tightened too much, nuts seats can be distorted, threads can seize and you may even shear off a stud next time you have to remove the nuts.

All manufacturers provide specifications to which wheel nuts on their models should be tightened—with a torque wrench.

Too often impact wrenches are used by professional service facilities. Impact wrenches can cause serious damage to nut seats. Look in your car owner's manual for the correct wheel nut torque specification for your car.

Another very important point is this: Wheel nuts should be tightened in an orderly fashion as shown. Helter-skelter tightening sets up stresses in the wheel and can cause brake-disc or drum distortion. Do the job right by following the pattern and first tightening each nut to half its full torque value (specification); then go back and tighten nuts to their full value, following the star pattern shown here.

made from the repair kit. Then the joint should be well lubricated.

Soft cams

I have a 1973 Volvo 145 which needed a new camshaft at 21,000 miles because of "extensive wear," the service manager told me. The car has received excellent care—better than what recommendations in the owner's manual call for. Work has always been done by an authorized Volvo dealer. I have never heard of a camshaft wearing out so quickly. Any idea what went wrong and led to this problem, and a bill for over \$325?—John D. Robinson, Columbia, Mo.

One likely possibility is that the original camshaft had so-called "soft" cams. The car came from the factory with a defective camshaft. It is not a frequent occurrence, but neither is it rare.

I would present the case to Volvo, Inc., through your service manager. Ask him to contact the Volvo distribution company in your region. There are five such agencies in the United States. Each has the "machinery" necessary for resolving customer problems.

Your presentation would be strengthened if you could get your service manager to tell the Volvo service representative that the metal was probably "soft." Hopefully, you or he saved the old camshaft. There's a possibility that Volvo will concur and stand part of the expense for repair.

Hesitating Datsun

My 1972 Datsun 510 wagon with automatic developed a flat spot on acceleration three months ago at 27,000 miles. I've had tune-ups and a carburetor overhaul. The dealer tells me he has done everything he knows. Maybe you can help.—J.L. Laurence, Fort Worth, Tex.

Here are a couple of ideas you can work with. Perhaps the engine has developed a vacuum leak. Check, for example, at the transmission modulator and the vacuum line leading to the modulator. Check all vacuum hoses, vacuum sources, parts that use vacuum and joints where a vacuum leak may exist, such as the intake manifold.

Another cause of flat-spot acceleration frequently overlooked is a weak ignition coil.

Paint problem

Two months ago I bought a white 1975 Camaro. I'm so happy with this car, but I got sick recently when I noticed that rust-colored spots the

(Please turn to page 128)

Your brakes are only as safe as your brake fluid.

It may come as a shock to you, but your brake fluid isn't all you would like it to be. By its very nature, conventional brake fluid attracts water and absorbs it into your brake system. Even if you have a "sealed system."

It's the water, of course, that eventually does the damage: corrosion, brake fade and, if you're not careful, brake failure.

Up until now, there was no way of getting around it; for more than 25 years, brake fluid has been unavoidably water absorbent.

STP Silicone Brake Fluid. A major breakthrough for safer stops.

Now there's a startling change. We've made brake fluid a new way: with silicone.

Very simply, STP Silicone Brake Fluid does not absorb water. Which means it helps your brake system operate more efficiently, more dependably, and most important, more safely.

Your brakes won't give out on you when the heat's on.

Because it remains water-free, STP Silicone Brake Fluid can operate effectively at higher operating temperatures than conventional brake fluid. Which means, your brakes can

keep up with the higher temperatures modern cars subject them to. And you don't have to worry about spongy pedal or brake fade.

Completely compatible.

As different as STP Silicone Brake Fluid is, it doesn't require any special modifications. It is absolutely compatible with the brake fluid you

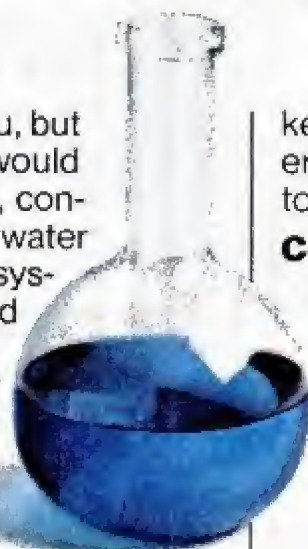


are using now. So you can switch at any time, whether you have a drum or disc brake system.

The Government's new standard for safety.

STP Silicone Brake Fluid meets the highest Federal Safety Standard, DOT 5.

So if you value your car—the time, energy and money you've put into it—put STP Silicone Brake Fluid in your brake system.



APPLIANCE CLINIC

BY PAUL MANN



Warming it up

I own a 1974 Sears automatic washing machine which has hot wash-warm rinse, cold wash-cold rinse and warm wash-warm rinse cycles. On warm wash-warm rinse, the water comes out cold. I would use the hot wash-warm rinse, but on this cycle the water barely trickles out and it takes forever to fill the tub. Can you suggest some solutions?—Mrs. Walter McDonald, Davenport, Iowa.

Certainly. The cause usually lies in one of two places: clogged sediment screens or an ineffective mixing valve. The company that makes this machine for Sears has had to redesign the mixing valve because of this problem. The new valve, which your machine may or may not have (it went into production in 1974), can be ordered as part No. 363425. The solenoid, which could cause the same trouble, is part of the valve and can't be purchased separately.

Before ordering the valve I would shut off the water, disconnect the hose couplings and inspect the small screens found inside them. These keep sediment out of the machine. If they get blocked (more likely on the hot-water side), the flow of water is impeded. Remove screens from couplings and clean them. A filter screen in the mixing valve also may be clogged and should be cleaned before a new valve is tried.

If you must replace the valve, it's not a complex job: Disconnect the line cord and shut off the water. Raise the lid and find the valve in the upper right-hand corner. Remove wires and hoses, noting all connections, and disconnect the valve. Install the new valve and connect all wires and hoses as before.

Part search

I have owned a Ling Temco dishwasher for 10 years—an excellent machine, but one that needs a new impeller. Letters to LTV Industries have been returned. James Industries of Wills Point, Tex., which used to supply me parts, no longer answers my letters. What can I do?—Harry Stowe, Grass Valley, Calif.

James used to make the dishwasher that carried the Ling Temco name. James is not in business any longer, and Ling Temco is no longer in the

home appliance business. Take whatever parts need replacing to a large appliance-parts store in your town or a nearby large city. Fortunately, many dishwasher parts are interchangeable. Your impeller can probably be replaced with one made by an active manufacturer.

Criminal element

My mother's electric Whirlpool clothes dryer doesn't heat on the permanent-press cycle, but does heat on the regular cycle. What's wrong?—J. H. Stockton Jr., Stockbridge, Ga.

Her machine has two separate heating elements, one rated at about 5600 w., the other, the permanent-press cycle element, at about 4800 w. This latter element has undoubtedly opened up, but there's heat on the regular cycle because the 5600-w element is unaffected. Check the 4800-w. element for continuity and replace it if it's bad.

Toothbrush saver

For all people plagued by a pooped-out rechargeable toothbrush (Appliance Clinic, page 42, April '75), let me offer some hope. I encountered a case where the contacts of the charging base built up a film—toothpaste, oxide, whatever. The charging voltage of the toothbrush is so low that any resistance across these contacts and the battery contacts lowers the amount of charge the battery receives. When my toothbrush pooped out, I carefully burnished the contacts with a pencil-type ink eraser. It worked. Maybe it will work for others.—G. L. Artus, Seattle.

Maybe. It's certainly worth trying before trading in the appliance.

Overprotection

Here's a problem I suspect other owners of Electrolux vacuum cleaners have. This machine is equipped with a system that shuts the vacuum off when the bag fills. The bag lock flips open and the vacuum stops. This occurs when the safety kick-out system malfunctions and knocks the vacuum out of action with a nearly empty bag. This happened to us twice. Can you tell why and if I can do anything to keep it from happening?—Oliver V. Lee Jr., Fort Worth, Tex.

The motor can burn out when a vacuum cleaner is operated with a clogged filter bag—airflow is curtailed and heat rises. The kickoff switch in the Electrolux senses reduced airflow and shuts the machine off, helping to prevent a burn-out. Whenever the vacuum picks up a lot of fine dust, the kickoff can create this problem—it happens in sandy areas, and when people vacuum basement floors and plaster walls or use the vacuum to clean up after remodeling. The fine dust clogs the pores of the inner bag, cutting airflow as a filled bag would.

If you operate under fine dust conditions, be sure the unit's control dial is set on "fine." Also, let the machine suck a clean facial tissue into the bag. Most fine dust picked up will cling to the tissue, leaving the bag's pores relatively clear.

Half-pound clue

Seven service calls in eight weeks at more than \$120 have left my Kelvinator frostfree refrigerator as sick as before. The unit was purchased in 1969. The freezer temperature stays at 20° F. The food compartment below is also warmer than it should be. The cold-setting dial mechanism and timer in the freezer wall have been replaced; ½ lb. of gas added and a solenoid in back replaced. Today the serviceman replaced the timer and solenoid again, and six hours later I had soupy ice cream. Should I get rid of the refrigerator?—Myer Ehrlich, Mattapan, Mass.

Keep the refrigerator—get rid of the serviceman. The most important information you gave is that ½ lb. of refrigerant had to be added. Refrigerant is lost when a leak develops. Even a loss of one ounce—let alone eight—can affect temperature. Have the entire system checked for leaks, with particular attention to the hot gas defrost system valve. I'll bet you'll find a leak which, when fixed, will cause a significant drop in freezer temperature. ★ ★ ★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N. Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.



Before remodeling



After remodeling



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Popular Mechanics—Sept. 1975

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George Orwell, who wrote a world-to-come novel predicting what life will be like in 1984, was right about one thing. He said Big Brother, alias big government, will call the shots for everybody and everything from conception to the coffin. In that respect, 1984 has already arrived for the auto industry. Big Brother makes the rules; auto companies toe the line.

But Detroit doesn't agree with this vision of a regimented, drab, everything-the-same society in the '80s. Automobiles then, car builders promise, will be exciting and imaginative. As dramatically different as a '70 car parked alongside an overdesigned, overchromed gunboat of 1950.

Detroit is already pulling together the pieces for cars of the '80s. Not metal and hardware. But automakers have a good idea of what the cars will look like, gear they will carry and how they will be powered.

You won't have to wait until 1980 to get a taste of what the cars will be like. Cars from which the 1984 models will evolve will be out in two or three years—the 1978-79 models.

Detroit is on a longer product cycle than before—at least twice as long. It used to change bodies every

Cars of the 1980s: What they will be like

Detroit Editor Robert Lund
interviews spokesmen from
the four automakers

There will be many year-to-year mechanical changes, but they will be evolutionary, rather than revolutionary, to use a pet phrase of automen. The revolutionary changes will come between now and '78-'79. By '79 the revolution will be over and there will be no vast changes in the outward skin, size or weight.

What comes after cars have been down-sized and defatted? Automakers will begin downsizing the mechanics of transmissions, propeller shafts, axles, springs, wheels, radiators. Even tires will be smaller.

Most cars, probably all small cars, will have front-wheel drive. FWD gets rid of the tunnel running through the passenger compartment. It allows a flatter floor, more room for people, more room in the trunk.

Most instrumentation will be the digital read-out type, not clock dials and pointers. Easier-to-read instruments will give more information.

Cars will have more glass, but few will have as much as today's Pacer. Glass will be thinner and stronger.

Some cars—all if the government has its way—will have seats permanently fixed to the floor in one position—no up-or-down, back-or forth move-



Harold C. MacDonald
Vice President, Engineering and Research
Ford Motor Co.



Dale E. Dawkins
General Marketing Manager
American Motors Corp.

Richard G. Macadam
Design Vice President
Chrysler Corp.



Dr. Craig Marks
Technical Assistant to the Vice President for Engineering
General Motors Corp.



two or three years. Now the same shell is used for at least five years. Vega and Pinto, for instance, will be going into their sixth year with the same bodies when the '76s come out. American Motors says it doesn't anticipate a major change in the Pacer body for 9 or 10 years. So the 1984 cars will be first cousins of 1978-79 models.

That doesn't mean Detroit will sit on its duff from '78-'79 until 1984.

ment. The steering wheel and foot pedals will move toward the driver, instead of the driver adjusting the seat to reach controls.

Equipment items that appear to have been tacked on the car—seat belts, shoulder straps, mirrors—will be integrated in the vehicle. Instead of hang-ons, they will be part-ofs.

New engines? American Motors thinks the Wankel may be ready by the '80s. Chrysler and GM think the

diesel stands a chance. Ford favors the Stirling and gas turbine. (See individual comments below.) There could also be some variable cylinder engines by the mid-'80s. That is, a V8 engine that lets the driver cut off cylinders in pairs, changing the engine from an Eight to a Six or Four for better fuel economy.

To find out what the four U.S. automakers are planning for the 1980s, PM interviewed executives of each. The companies, usually skittish about discussing future products, don't like to tip their hands until the cars are ready. But they'll talk trends and the long view.

PM's questions were fielded by Dale E. Dawkins, general marketing manager for American Motors; Richard G. Macadam, design vice president for Chrysler; Harold C. MacDonald, vice president of engineering and research for Ford, and Dr. Craig Marks, technical assistant to the vice president of engineering for General Motors. (Dawkins' job is primarily sales and he might seem an unlikely source of information on AMC's cars of the future. But his title of marketing manager is new. Prior to being promoted, he was director of product planning for the company, working on down-the-road cars, so he knows what's on the boards at AMC.)

PM asked each of the auto execs the same six questions. Here are the questions and replies:

■ **Are the cars of the 1980s going to take on a homogenized look, so you**

can't tell one from another? Not only U.S. cars, but foreign cars, too. There's a trend now to a world car look—American cars becoming more European and European cars becoming more Americanized.

American Motors: We're the guys who do things differently, so we

"... I don't think cars are going to look alike."—Dawkins

thought about this before you asked the question. Two things are happening that could tend to make cars look more alike. All cars are coming down in size. Number two, in the next seven or eight years everybody is going to increase interior space for people. The combination of these forces will make it difficult to retain individuality. But I don't think cars are going to look alike.

I think the styling guys are going to get in the traces and say, "We're not going to let that happen." There's a major move in the industry not to allow that to happen.

Chrysler: There's no question U.S. cars and foreign cars will move closer together in terms of size, more efficient sizes. More cars will be crowded in a given range of design possibilities. But the function of the designer is to develop products with significant differences within that reduced range. You will continue to see marked differences in appearance, despite the trend to smaller cars.

Ford: Cars will be closer together on dimensions—the compact look, fewer frills, less overhang front and rear. But having seen the products we are working on for '78 and '79, I can tell you they will be very distinctive cars.

General Motors: A tendency is developing toward Americanization of European cars and vice versa. That's because manufacturers and designers everywhere face similar constraints—fuel restrictions, materials availability, labor rates, safety and emissions standards and so forth. Even so, American designers will

"I can tell you they will be very distinctive cars."—MacDonald

continue to come up with fresh ideas to distinguish U.S. cars from European cars.

■ **Do you think most cars of the 1980s will be for two or four passengers, instead of the five and six-passenger cars of today?**

American Motors: Not many two-passenger cars, but more honest four-passenger cars. As an industry, we've been a little less than truthful in designing cars as five or six-passenger cars that weren't really very comfortable for five or six people. They are really four-passenger cars. We'll have more honest four-passenger cars in the 1980s, but will still build five and six-passenger vehicles.

Chrysler: I think the four-pas-

COMEBACK OF THE COMPACT WAGONS

by Michael Lamm
WEST COAST EDITOR

As American cars grow smaller, today's compacts will become tomorrow's intermediates. The compact station wagon will come out of hibernation and might well, with-

in just a few years, dominate the U.S. wagon market. Here's a rundown of what we expect to happen.

Chrysler Corp., which built its last compact wagons (Valiant and Dart) in 1966, will introduce a new line of compact wagons (Volare and Aspen) for 1978.

The last Chevy II (Nova) wagon rolled out

of the factory in 1966 also. Today, Chevrolet is readying a redesigned Nova wagon for 1978.

Ford's final Falcon station wagon was built in 1970. A wagon version of the Maverick/Comet has been contemplated but never launched. Ford has built and tested wagons in the Granada/Monarch lines and could put

Plymouth Volare and Dodge Aspen station wagons go on sale this fall. They'll compete with the AMC Hornet Sportabout which has had the compact wagon field all to itself.



Illustrations: Harry Bradley

senger car—specified for four people—will become a great deal more popular than it is today. But we will still have five and six-passenger cars.

Ford: Our packages will continue to accommodate five people comfortably, six people in some cases. Of course, a lot depends on what kind of

"I think the four-passenger car . . . will become a great deal more popular than it is today."—Macadam

legislation we get out of Congress. If Congress decides every car on the road has to give 28.5 miles to the gallon, it would be tough to produce much over a four-passenger car.

General Motors: Cars of the 1980s, like those of today, will reflect market demand. They will cover a very wide model range, from two-seaters to vans or wagons for eight or more passengers.

■ **Do you foresee the automobile of the 1980s changing from a mechanical creature to an electronic creature? How far can you go with computer controls?**

American Motors: We're going to see more electronics, particularly in the area of engine control. There are some real breakthroughs coming there to give improved efficiency. But outside of that, I think electronics will come slowly. Computer technology for cars is an attractive idea to talk about. But the dollars to go after

it are very unattractive. And we get into an even tighter crunch on value for the dollar and the price of personal transportation, those things are going to be a deterrent toward a rapid, wholesale use of electronics.

Chrysler: We're working on computerized control systems that will make the car function more efficiently. Our lean-burn engine coming on some '76 cars is a good example. We're also working to extend computer information to other areas of the car, such as the automatic transmission. We are working on some exotic stuff we think will make driving fun again. Imagine the games you could play if you had a display

"We think you'll see more front-engine, front-wheel drive and rear-engine, rear-wheel drive in cars of the future."—Marks

console you could set for the number of miles you want to drive on a particular trip. You could then take readings off the console of the number of miles you've traveled, how many miles you have to go to reach your destination, estimated time of arrival, average speed at which you're traveling, how many miles you're getting per gallon depending on how you're driving. That would make driving a very entertaining experience. We're working on it.

Ford: We are developing electronics for the engine and the fuel

handling system. As we get a small central computer incorporated in the car, we can piggyback in such things as the automatic transmission, speed controls, maybe an automatic temperature control—anything that can be actuated by a signal.

General Motors: The automobile is going to remain a mechanical creature, but with an increasing number and type of electronic controls. Range of the controls depends on costs and reliability of sensors, transducers and actuators that interface with the electronics. There's practically no limit to the number of functions that can be controlled electronically.

■ **Will cars of the '80s be powered by new types of engines—turbine, steam, Wankel, diesel, electric or whatever? Or are you going to stay with the conventional piston engine?**

American Motors: We still have an active rotary program and we see that as a good possibility down the road. The sobering part of any question about engines is the arithmetic. The domestic auto industry currently has a capacity to produce between 1600 and 2000 engines an hour, depending on whether we are in good times or bad. The industry normally produces 1800 to 1900 engines an hour. You can turn out about 50 engines an hour on a major line. The cost of building a line to produce 50 engines an hour is upwards of \$75 million. And we need 1800 to 1900 an hour. A little quick arithmetic will tell you this industry is not

(Please turn to page 112)

them into production for 1977 if demand warrants. More likely, though, Ford will wait until 1978, especially since sales of Pinto and big Ford wagons are currently leading the industry.

Only American Motors has built an almost uninterrupted series of wagons since 1951. Its present Hornet Sportabout wagon has en-

the only U.S.-made compact wagon around.

That now seems to be changing even within AMC itself. For 1977, there's quite likely to be a wagon version of the popular Pacer. Rumor has it that American Motors is working on both two and four-door Pacer wagons. These will have great amounts of glass and, unlike the current Pacers, will have lockable

built into both sides of the cargo deck. We foresee brisk sales of these new Chrysler F-bodied compact wagon lines.

GM is currently redesigning its X body (Nova, Ventura, Omega, and Apollo) for 1978. Details are scant so far, but it's said that a wagon version could be boxy, thus roomy, with good space utilization and plenty of



AMC Pacer in station-wagon configuration could be an even more exciting vehicle than the two-door Pacer. This concept shows how it might look.

joyed increasing popularity since its 1971 introduction. The Sportabout currently accounts for over half of all Hornet sales. In 1971, for instance, the Sportabout sold 22,000 units. In 1972, that figure rose to 32,000, then 41,000 for 1973, and 64,000 in 1974. Much of its acceptance came from its size, price and styling, but part came from the fact that it has been

and hidden storage compartments as well. Chrysler Corp.'s twin Aspen and Volare wagons for '76 share basic bodies and mechanical components. One-piece lifegates with fixed rear windows help keep prices down, yet cargo areas are approximately two-thirds the size of Chrysler's current Coronet/Fury intermediate wagons. Deep storage wells are

glass. The idea with GM's projected X-bodied wagons is to maximize space inside with tight outer dimensions, which means less front overhang, thinner doors, and square lines. What GM is trying to do is include room for a third seat. If they can manage that, it'll be the breakthrough compact wagons have been waiting for.

The race you win by riding slow

Trials riding is like motorized tight-rope walking

by Charles Self

You ride them standing up. That's one reason observed-trials motorcycles are so odd looking. Skinny is the best word to describe them, with their tall ground clearance, low, tiny seat and narrow engine cases and handlebars for squeezing through tight places. Foot pegs are far aft so you can shift your weight for lofting the front wheel. They're designed to go in the more rugged, slippery places where you'd have trouble just trying to walk.

The worse the place, the better for trials riding. And, little land is needed for this 75-year-old sport: in fact, a large back yard, say 100 by 150 feet, could be used if there were enough obstacles. Low speeds keep the danger down. Helmets have seldom been required in competition while odd and colorful caps have become the standard headgear. But that's for pros; everyone else should wear a helmet!

Trials competition is a "trial" for man and machine. The events take place within marked boundaries with no time limit set for the riders once they've entered a "section." Each section will differ from the preceding, with obstacles ranging from high drops, to three-foot logs, to almost sheer embankments, to mud and large rocks.

Expert sections are usually laid out with tricky turns at the bottom of hard climbs and acute-angle turns at the tops.

Every rider starts even, with a given number of points, then loses marks for putting a foot down in a section: that's called a "dab." More marks are lost for stopping, crossing one's own tracks or going out of bounds. Observers, or judges, are po-

sitioned along the course: hence, "observed trials."

For the average rider, there is no "best way" to develop needed skills. Through practice he'll learn exactly how to place his body for whatever reaction is needed or wanted. He can actually get in a lot of riding on parking lots, yards, or anyplace where there are enough obstacles, or where such things as rocks and railroad ties can be moved in place for practice. Try riding along a railroad tie for a good lesson in steadiness, balance and throttle control!

Not long ago, when observed-trials competition was booming in Europe, three Spanish manufacturers dominated the market: Bultaco, Montesa and OSSA. Now, with the increased popularity of trials-riding in this country, four more makers are in the market—Honda (with the only four-stroke bike in the field), Kawasaki, Suzuki and Yamaha. Engine sizes run from 250 to 350 cc. A novice should remain with a 250-cc or smaller machine, which, though it may have limited power, won't get a new rider in trouble. The engines are decidedly understressed, low revving units designed for low-speed grunt. All the bikes cost between \$1000 and \$1500.

Bultaco leads the alphabetical list with a fine Sherpa model trailer. Rated at 20 hp, this bike has 11.6 inches of ground clearance and a dry weight of 198 pounds. The Bul also comes in a 350-cc version, for experts only.

Honda's big trials bike is the TL250. Neither Honda nor Yamaha lists horsepower on trials machines. The ground is 10.2 inches under the lowest frame point, and dry weight

is 220 pounds. For the lightweight or rank beginner, Honda offers its TL125 for about \$600.

Kawasaki's KT-250 turns out 17 ponies and has a ground clearance of 11.8 inches. Dry weight is 212 pounds.

Montesa offers the largest number of machines, opening things up in the 250 bracket with its 247 Cota. Ground clearance is 9.8 inches, weight is 213, and the machine is rated at 20 hp. The line includes the Cota 25, Cota 123, Cota 172 and Cota 320.

OSSA's Mick Andrews Plonker has a ground clearance of 9.8 inches, weight is 197 pounds and the engine thumps out 19 hp. Rumors of a 350-cc version for 1976 keep cropping up, but so far there's been no confirmation.

Suzuki's RL250 offers 11.4 inches of ground clearance, 18 hp and a 199-pound dry weight.

Yamaha was the first Japanese maker to go to a European trials champion to help develop the machines: the TY250 Cat shows the Mick Andrews influence with its superquick handling and tight turning circle: With an overall length of 78.1 inches (a wheelbase of 51 inches), the Cat has a turning radius of only 53 inches. The TY250 has 11.2 inches of ground clearance and dry weight of 205 pounds. Yamaha also produces 80 and 175-cc versions for the small fry and the smart novice.

That's the world of the observed trials motorcycle. It's the safest and quietest of all motorcycling sports, while still demanding great skill. Trials is also the best training for any kind of motorcycling you may wish to move into later, from road riding to all-out competition. ★★



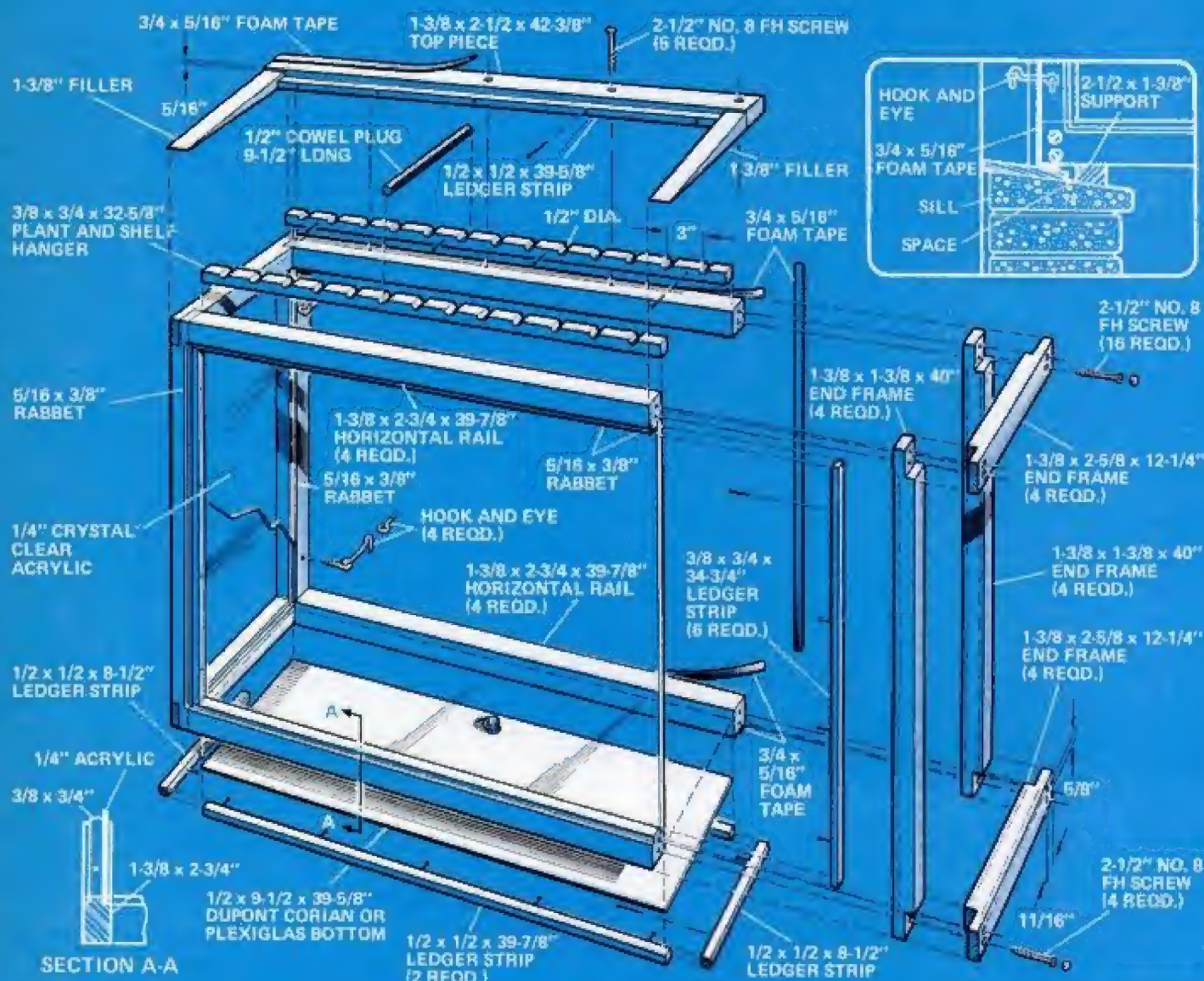
Trials riding is an exercise of balance and coordination on machines designed to rival mountain goats with their ability to tackle the most treacherous terrain imaginable. In picture No. 1, a rider starts down a sharp drop on his Honda trials bike. Pictures 2 and 3 show some fancy turning on a Kawasaki; 4 and 5 prove that boulders and logs don't stop these accomplished riders on their Suzuki machines. Photos 6 and 7 show a Yamaha rider running the length of a log and turning on one wheel in parking-lot competition.

WINDOW GARDENING

—you can do it too

Here are two ways to bring nature into your home—one ready-made, the other a do-it-yourself project.

by John Gaynor and Harry Wicks



Art: Peter Trojan

You can add a touch of year-round beauty to your home by converting a window into a lush greenhouse. Decorative plants of different varieties will provide a display that can be enjoyed from the inside—and outside—of your home. If there's a gardener in the family, the window can double as a "hothouse" for propagating plants well in advance of the outdoor gardening season. You can pick an easy-to-install commercial unit, such as the Nature Bubble (bottom photos at right). Or you can build the greenhouse detailed above on these two pages and on the following page. Designed especially for PM, it is a true window greenhouse.



Photos: Chuck Rogers, Black Star



More than just a window display of pretty plants, PM's window greenhouse lets you add heat and supplemental light, if desired. The unit, designed to contain moisture, also boasts a clever, independent method of ventilating for complete climate control. The greenhouse is as attractive on the outside (above) as from the inside (left). Fashioned of clear all-heart redwood and Plexiglas, it is self-contained. Thus, existing window sashes can be left in place — you need not remove them in order to install the unit.

The Nature Bubble (below) is a commercially available "greenhouse" that installs as easily as a portable air-conditioner. The lower sash is simply raised and the unit screw-fastened in place. Filler panels and weatherstrip supplied keep out drafts and rainwater.



Photos: Alie Dulberg

Ideas that make this greenhouse great



3 4



1. Plant hangers are cut from $\frac{3}{8}$ -in. steel rods that, like all metal parts, are sprayed with flat black Rustoleum. 2. Plastic top is held in open position with one wood hinge at each end. Spring prevents top chatter in stiff breezes. 3. Shelves of $\frac{1}{4}$ -in. Plexiglas are cut to length and 12 in. wide. When a $1\frac{1}{2}$ -in. flange is bent along each side a shelf width of 9 in. is left. 4. The unit shown is held in position with four screw eyes and hooks. Foam tape keeps out drafts and water.

■ As in full-scale greenhouses, moisture must also be contained. Here, because window sash remains in place, you assure the greenhouse climate being independent of house climate.

■ You must also be able to install supplementary plant lights if needed. On this model it is simply a matter of running in the electric wire.

■ While a southern exposure is ideal because of its sun and warmth, other window locations can be used so long as they receive at least some direct sunlight during part of the day, especially in winter months.

the inside plane of the Plexiglas and frame are flush. As a result, all condensation collects on the bottom (which, in turn, is pitched forward toward the front) on a water-imperious material where it can be removed by sliding back the bottom. Additionally, the bottom is easily removed for cleaning out any dirt or leaves that may collect.

To finish the greenhouse, apply two coats of exterior varnish to the redwood frame.

What makes a good greenhouse?

Whether you plan to use your window greenhouse for plant propagation or just plain enjoyment of flowers, certain features must be incorporated in order for the unit to be a true greenhouse.

■ Provision for ventilating is necessary. PM's version with operable top and bottom gives good air flow even with sash closed.

■ If the climate and your growing plans dictate, you must have provisions for heating. On this model it's a simple matter to install a commercial electric heater.

Built-in advantages

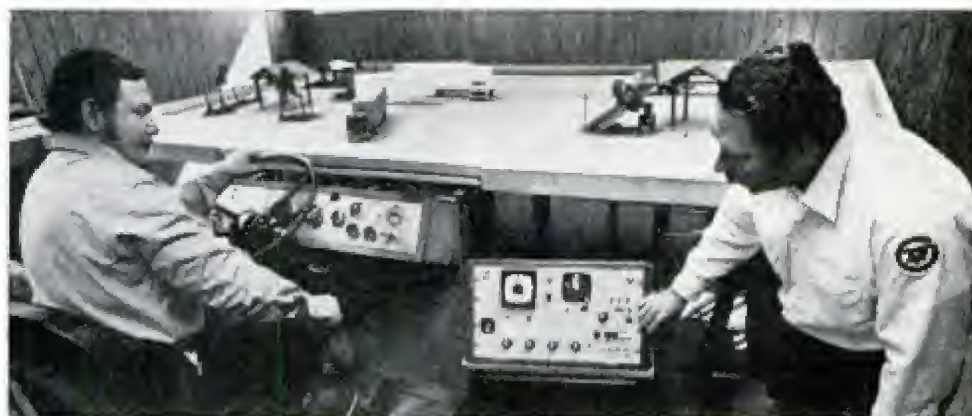
Because the unit attaches with just four hooks and eyes, fastening in the window opening is easy. And the unit is self-contained; you don't have to remove the window sash. This means no drafts in the winter and no need for caulking or waterproofing.

Good construction features

Fashioned of $\frac{1}{4}$ -in. Plexiglas and redwood, the box is designed so that

Commercial version

The plastic window garden on the preceding page is called Nature Bubble by its maker, Feather Hill Industries. Box 41, Zenda, Wis. 53195. Priced at \$69.95, the unit is ideal for those who are more interested in getting the jump on spring by starting garden plants inside and moving them outdoors when weather permits. Instructions for mounting the bubble are packed in the carton. Installation time is about one hour. A tray for germinating seeds is included. If desired, it can be used instead to hold potted plants. ★★



They learn to drive big trucks by 'playing' with little ones

Student truck drivers experience all the tricks and hazards of highway driving except for one big difference—their "cab" is in a quiet classroom and their giant "rigs" are small radio-controlled models. The system, developed by Driver Training Institute in Brooklyn, N.Y., consists of a full-sized truck cab mockup with all the controls of a real truck (top photo above), plus various "obstacle courses" trainees must master with their models before going out on the open road. In lower photo above, a student, with only his side mirrors for guidance, cautiously backs a "huge" tractor trailer into a loading dock. And just to make things extra tough, the instructor can electronically feed special situations into the system, such as sudden road emergencies like brake failure or bad driving habits like clutch-riding, to test a learner's reaction. Results, say school officials, are faster, safer learning and elimination of mistakes that could be costly and dangerous in actual practice.



Easy bagger for grass cuttings

Grass cuttings are quickly disposed of with this "Zip Kit" attachment for any V-Series Snapper power mower. A standard plastic trash bag is clipped to the handle and catcher's contents dumped in. Remove bag, tie it off and you're done.



Going nowhere fast

The gal rider above isn't going anywhere, but she's having a wild time doing it. The mechanical horse, a training simulator developed in Japan, provides realistic trotting, cantering and galloping gaits up to the equivalent of 40 mph.



Small hand-held laser spots military targets

The gunnery spotter above can sight an enemy target and tell exactly how far away it is. His instrument sends out a laser beam, records reflected-light time and shows the target's range in an almost instant readout. The RCA device is said to be many times more accurate than conventional rangefinders.



Steam taxi: More passengers, less pollution

The steam car is back—and being taken seriously. This sleek, five-passenger, steam-driven vehicle is under test by the U.S. Department of Transportation for use in city taxi service to increase people-carrying and reduce pollution. It was developed under a \$1-million government contract by AMF, Inc.

The tallest structure in the world is the 1454-foot Sears Tower in Chicago, right? Wrong. It's the Warszawa radio mast in Plock, Poland—2119.4 feet high. The longest known fence stretches 3437 miles around an Australian sheep ranch. And something else you may not know: A Rhode Island hen named Penny laid seven eggs in one day!

Want to fight about any of these statements? Don't. They're all documented in the "barroom bible" of superlatives—*The Guinness Book of World Records*. Anything you want to know about the highest, lowest, biggest, smallest, fastest, slowest, oldest, loudest, greatest, hottest, coldest, strongest—the mostest or leastest of anything—is in this amazing 688-page, inch-thick collection of stupendous facts. The annually updated almanac is published by Bantam Books (\$1.95) and compiled by a pair of personable, energetic British twin brothers, Ross and Norris McWhirter.

How the book got started is almost as fascinating as its contents. It all began more than two decades ago in England where arguments in pubs over disputed facts would lead to fist-fights, smashed bars and local disapproval—all bad for the brewery business. The Guinness Brewery in Dublin—famous for its Guinness stout—wanted to stop this unseemly behavior and came up with the idea of producing a handy source of answers to settle barroom disputes once and for all. The McWhirters, then running a facts and figures research service in England, were hired for the job and have been at it ever since.

"The first issue took off like a rock-

et," says Norris. "Today it's printed in 14 languages, and we're currently selling 80,000 copies a week—more than 4 million a year."

The McWhirters have to be as much shrewd detectives as able editors. When you're in the records business, you're a target for all kinds of cheats and crackpots who will do anything to get their name in print. Weeding out the fraudulent from the genuine is one of the twins' biggest tasks. Besides requiring elaborate authentication of any feat or event, the brothers also rely heavily on their own common sense to avoid being hoaxed.

Thwarting the thruppence fraud

There's a continuing competition, for instance, to see who can stack the most British hexagonal thruppence coins on edge. "The current record is 12," notes Norris, "and suddenly we get this claim of 14, which is absurd. You don't break a record by two if you can do it with one, now do you?"

The photo clearly showed the coins stacked on a table with a chair beside it, yet something didn't seem quite right. Stacking the coins is very tricky and usually requires turning some of them at angles to make them balance. These coins were stacked neatly in a straight row—a bit too neatly. When questioned closely, the imposter finally admitted he had glued the table and chair to the ceiling and suspended the coins with tape on the back side. "We were simply looking at the picture upside down, he told us nonchalantly."

Another stacking contest involves building up "houses" of playing cards. The present record is 34 "stories" using seven decks. Last year a man came in claiming 58. The McWhirters are always particularly suspicious when a record is broken by too wide a margin. "It seemed ridiculous," says Ross, "yet he had all kinds of witnesses and affidavits, including TV coverage. We questioned the TV crew and they verified it, but just as we were about to leave one technician remarked, 'You know, it was really

interesting the way he bent those cards.' So there we had it."

Amateur buffs are a big help in the checking of claims because they often know their pet subjects better than professional experts. For example, London and New York have subway rider clubs whose members compete to beat the best time for riding the entire system from end to end. The record for London's 252 miles and 277 stations is 15 hours flat.

"Well, a lad shows up claiming he had broken the record by several hours," explains Norris. Like the house of cards, the margin was too wide to be logical so the brothers turned the character over to the London Underground Rovers, an organization of subway buffs. They really gave him the treatment:

"Now what day did you make the run on the Knightsbridge-Chelsea line? The fifth, you say? Interesting. That branch was closed from 9:02 a.m. on the fourth to 6:31 p.m. on the sixth." The phony was quickly unfrocked.

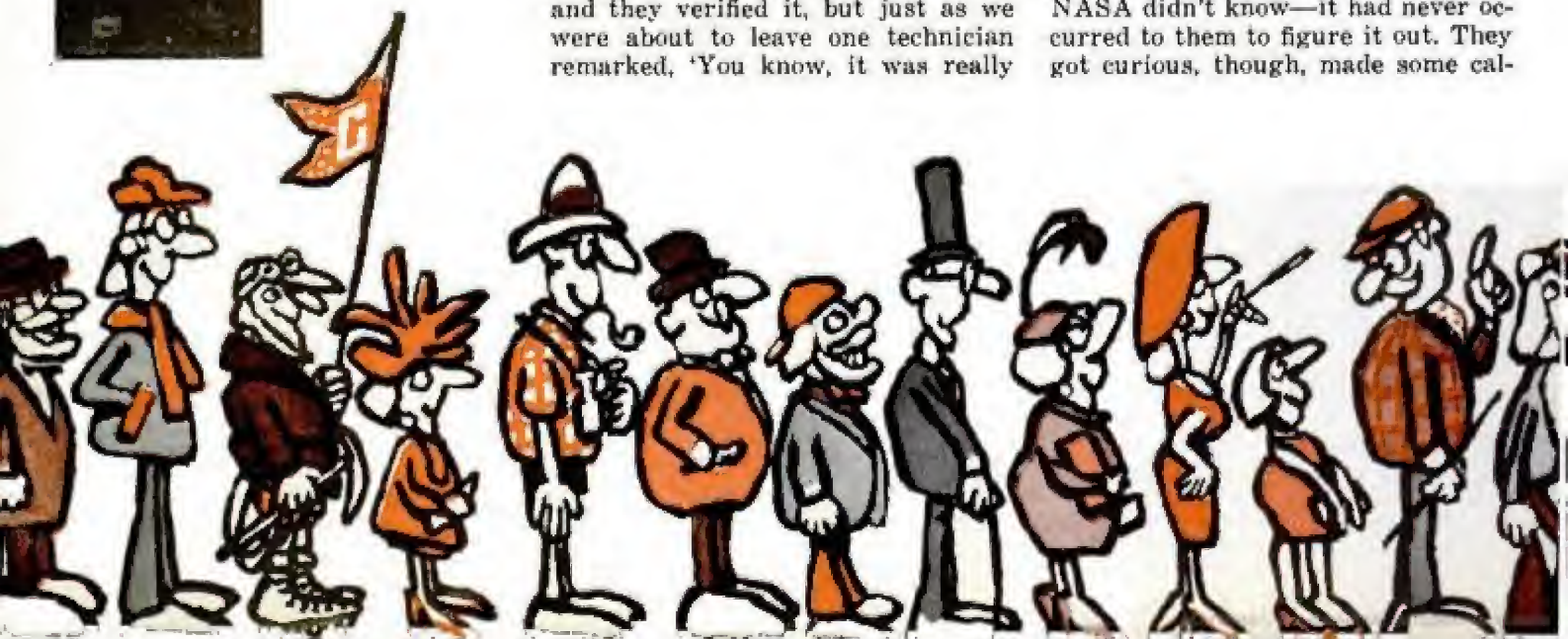
Fastest human

In addition to every conceivable official record, the *Guinness Book* also includes such tantalizing off-beat tidbits as the longest recorded skid marks (nearly 6 miles made by Craig Breedlove as he lost control of his jet-powered car on the Bonneville Salt Flats in 1964); world's largest sundae (2056 pounds of ice cream and 17 gallons of chocolate sauce); oldest airplane pilot (an Oregon woman still flying at the age of 100). Guess the fastest nonmechanical human speed achievement: A sprinter? Speed skater? Ski racer? Nope. It's 614 mph set by a free-falling sky diver.

To establish the latest altitude record, the McWhirters wanted to know how far Stafford and Cernan were from Earth on the Apollo 10 flight. NASA didn't know—it had never occurred to them to figure it out. They got curious, though, made some cal-



McWhirter twins, attired in official McWhirter Clan dress, are smiling team of astute editors who can also be tough.



culations and came up with a distance of 248,433 nautical miles. This remained the record until Apollo 13 beat it by 232 miles a year later.

The McWhirters do not encourage feats considered dangerous or distasteful. No liquor-drinking records are included. Gastronomic accomplishments, such as pie and pancake-eating records, are listed but frowned on. "It's reached a point where the technique now is to induce vomiting and start over," points out Norris. "It's disgusting."

The same goes for car cramming. It's silly and unsafe. "We did it for a while," Ross admits. "One group managed to pile 100 in and on a VW Beetle. They had to remove the tires so they wouldn't explode, and the bare rims gouged up a valuable gymnasium floor."

How do you get into the *Guinness Book*? There's an established procedure detailed in the front of the book, but in brief, if you think you've achieved some feat that warrants inclusion, send the claim to Guinness Superlatives, Ltd., 2 Cecil Court, London Rd., Enfield, Middlesex, England. It must be accompanied by independent corroboration in form of newspaper clippings, radio or TV tapes, signed affidavits from witnesses, confirmation by recognized official organizations—anything that helps to authenticate the claim. But don't try to fool the McWhirters—you can't. ★ ★ ★

Biggest, fastest, tallest, smallest— You name it, they got it

The Guinness Book of World Records is a fascinating compilation of amazing facts — but it takes a shrewd team of detective/editors to keep it accurate. by Richard F. Dempewolff



How many people can you get in — or on — a car? In the last recorded feat, 100 managed to scramble aboard — guess what? — a VW Beetle!

'Open-air' headsets:

SUPEREX TL-3

SUPEREX PEP-74

PICKERING OA-2

PICKERING OA-3

SENNHEISER HD414

SENNHEISER HD424

ROYAL SOUND HP-40

ROYAL SOUND HP-42

by Hans Fantel

Ever since stereo headsets first appeared more than 10 years ago, most of them have looked—and felt—like space helmets. They formed a tight seal around the ears, which served two functions: 1. It shut out outside noise, providing instant privacy for listening. 2. It trapped the air between ear and the headset, establishing a closed system for efficient sound transmission. The air seal assured what engineers call "close coupling" between the moving parts of the system—the diaphragm of the headset and the eardrum. Such a system functions almost as if a push-rod were connected between the diaphragm and the eardrum and few of the audio frequencies get lost along the way.

But the familiar seal-type headsets have several drawbacks. They are

uncomfortable to wear for long periods because under the seal you get hot and sweaty. Besides, many listeners don't like to be completely isolated from their acoustic surroundings. They still would like to hear the phone ring or someone calling out to them even while listening with headsets. Finally, the closed system, for all its theoretical advantages, is not the natural way of hearing. To many listeners, the sound seems too close and immediate and therefore irritating after a while.

To overcome these drawbacks, a growing number of manufacturers are now turning to a different type of "open-air" headset design. Rather than fitting seals around the ears, these headsets sit on top of them, allowing partial airflow around the edges. They are also much lighter than most seal-type headsets. Both these factors make them less tiring to wear.

They're easy on the ears in other ways, too. Their sound, less dramatic and intense than that of closed-system headsets, more nearly duplicates the "natural" way of hearing—another open-air system, with our ears sticking out into our environment. At first, many audio fans believed that the open-air design would lessen bass response, but this fear proved unfounded: The acoustic coupling between the moving parts and the ear is still close enough to produce solid bass.

As with surround-type headsets, the best of the open-air models sound better than most loudspeakers, certainly better than loudspeakers of equal cost. A \$50 headset can, in fact, outperform even a \$1000 pair of speakers. This doesn't mean that earphones are a cheap substitute

easier on your ears

PIONEER SE-700



TELEPHONICS TEL-101F



LAFAYETTE F-600



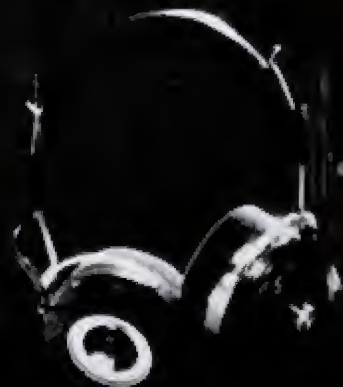
AKG K140



REALISTIC LV-10



ROYAL SOUND HP-50



KOSS HV/1LC



STANTON DYNAPHASE 28

for speakers. The subjective listening experience speakers give you is quite different. But if your budget forces you to skimp on speakers, you can still get ultrafidelity at a bargain price from a good pair of earphones, and even with a fairly low-cost, low-power amplifier earphones will put out all the sound your ears can take. It takes only a few watts to drive headphones to full volume—and you can listen without bothering your family or neighbors.

Earphones are also immune to the problems of room acoustics. Because the sound goes directly to your ears, the sound you hear when you test phones in the showroom is exactly the sound you'll get at home. Because acoustics differ so much from one room to another, this is hardly true of speakers.

And earphones exaggerate the spatial effects of stereo, to a degree some find ecstatic, and others call unnatural: You feel as if the orchestra and hall spread out around—and through—your head. (Oddly, the Telephonics, so far the best four-channel headset, gives less of a quadraphonic effect than speakers.)

All headsets tested in this report cover the full range of musical frequencies from 20 to 20,000 Hz. You may wonder how the lower bass frequencies can be effectively reproduced by diaphragms measuring only about three inches or so in diameter while ordinary loudspeakers must be fairly large for adequate bass response. The answer is that loudspeakers must push plenty of air to project bass energy into a room-size listening space. But for the small space between the headsets and your eardrums, small sound generators suffice. What's more, the

back-and-forth excursions required of the moving parts are only very short, which permits more linear mechanical response to the electrical impulse over the entire span of travel. As a result, distortion in the better headsets is remarkably low, usually lower than even in the best loudspeakers.

Operating principles. Most models tested in this report are so-called "dynamic" headsets—small versions of conventional loudspeakers, consisting of a permanent magnet, a voice coil, and a cone-shaped diaphragm (or dome-shaped, in the case of the Sennheisers). But a few in this group employ radical innovations: Yamaha's HP-1A is an "orthodynamic" design with a flat, polyester diaphragm that moves between two perforated, disc-shaped magnets whose

polarities alternate like checkerboard squares across their surfaces. Since the voice coil is imprinted over the entire diaphragm surface (same size as the magnets), the diaphragm isn't just pushed and pulled from the center or rim as in standard dynamic designs, but is moved by magnetic forces evenly distributed across its surface. The diaphragm moves as a flat, unflexing piston, with all points in phase, for exceptional sound clarity.

Pioneer's SE-700 has the same kind of planar piston motion, but gets it from a plastic film diaphragm coated with an ultrathin aluminum layer. This structure is piezoelectric—it expands and contracts as the changing, electrical signal from the amplifier is applied to it, moving the air to produce sound. This direct translation of electrical impulse into physical motion gives the Pioneer remarkably clear, undistorted sound.

The Superex PEP-74 headset produced similarly clean, translucent sound, with superbly defined highs and lows, for the same reason: a diaphragm that moved as a unit, without flexing. Here, though, the moving principle was electrostatic: The thin, metallized diaphragm moves between two closely spaced metal screens which carry opposite d.c. voltages; the diaphragm, which carries the rapidly alternating polarities of the audio signal, is alternately attracted first to one screen, then to the other. Unlike other headsets, which plug into standard telephone jacks, the Superexes (and some other electrostatics) must be plugged into adapter boxes which supply the d.c. polarizing voltages. These boxes connect between the amplifier speaker terminals and the speakers; a switch on the adapter shuts the speakers off for headphone listening.

Sound and comfort. Testing headsets for sound quality is subjective, but testing them for comfort is more subjective still—heads differ. Even so, our tests could pinpoint important differences. We rated comfort on a scale of 1 to 10 (see table at right), registering our impressions only after wearing each phone for 20 minutes. As expected, the lighter headsets tended to be more comfortable. Standouts in this respect (as in others) were the AKG and Yamaha, which feature dual headbands: a solid, outer band which controls pressure on the ears and a softer, inner band which distributes the weight gently and evenly across the head. (You can see me wearing the Yamaha version at the top of this page.) The AKG even has an automatic head-size adjustment. The Pioneer and Pickering's OA-3 ranked next in overall comfort.



Dual headband on a Yamaha distributes pressure for best comfort. AKG is similar.

In judging sound, we checked out each headset on clean, wide-range recordings of symphonic and vocal music and jazz. It became obvious that the models with flat, uniformly driven diaphragms have an edge in clarity. The Pioneer, Yamaha and Superex PEP-74 achieve a level of excellence that leaves little to choose between them. They are silky, smooth and crisp, with a fine natural balance, though the Yamaha and Superex had richer lows. They handled the glowing score of our symphonic test disc and the lean, biting sound of the modern jazz recording with equal ease and astounding realism. The Superex's extended highs did, however, tend to emphasize surface noise on records—the price of perfection, I guess.

As to the rest of the group, their similarities in sound were, for the most part, more striking than their differences. The AKG almost matches the superb clarity of the models already mentioned, combining overall smoothness with plenty of solid punch

at both top and bottom frequencies.

There was especially little difference between the two Sennheisers: both sounded beautifully clear and balanced, with the 424 having a bit more bass.

Lafayette's F-600 had a similar "open" sound, though not as bright in the highs.

Pickering's OA-3 and the Koss HV/1LC sounded particularly rich and warm, yet with nothing missing on top.

The Pickering OA-2 and the Stanton Dynaphase seemed almost identical—they were smooth and well-balanced, with a very natural sense of aural space.

Royal Sound's HP-42 and HP-40 have good clarity and range, but the same company's Model HP-50 was inferior—rough on top and weak at the bottom. There was also a trace of roughness in the Realistic LV-10's highs, though the overall balance was good.

Telephonics deserves special mention as the only four-channel headset with open-air design. The sound is quite good, both in quad and stereo, but the size and weight of this model (caused by the extra drivers which reproduce the rear channels) make this by far the least comfortable of the phones tested. (As we go to press, Telephonics has new drivers, with lower impedance that will improve their sound on preamplifier and tape deck outputs, but which may also alter the sound—for better or worse—in other ways. And John Fixler, who designed the originals, has announced his own line of similar, but lighter Discophones.)

Is open-air design the coming trend in headphones? After listening to and wearing these phones, I'd definitely say so. ★ ★ ★

THE 17 HEADSETS WE TESTED:

Make	Model	Weight (oz.)	Comfort Rating	Price	Remarks
AKG	K140	6	10	\$35	Pressure-equalizing dual headband with automatic head-size adjustment.
Koss	HV/1LC	10½	4	\$55	Individual-ear volume controls.
Lafayette	F-600	6½	7	\$25	
Pickering	OA-2	7½	7	\$23	Both Pickerings supplied with monophonic adapter plugs for use with TV set and portable radios or tape recorders.
Pickering	OA-3	7½	9	\$40	
Pioneer	SE-700	9½	9	\$80	Piezoelectric driver. Very flat profile. Excellent sound.
Realistic	LV-10	9½	3	\$40	
Royal Sound	HP-42	8	7	\$30	
Royal Sound	HP-40	6½	6	\$35	
Royal Sound	HP-50	4	9	\$50	Very flat profile.
Sennheiser	HD414	4	9	\$46	
Sennheiser	HD424	6	8	\$75	
Stanton	Dynaphase 28	8½	6	\$28	Supplied with mono adapter plug.
Superex	PEP-74	9½	6	\$90	Electrostatic; connects to speaker terminals through control box.
Superex	TL-3	9	6	\$40	
Telephonics	TEL-101F	17	2	\$60	Four-channel headset.
Yamaha	HP-1A	8	10	\$85	"Orthodynamic" driver, Pressure-equalizing dual headband.

SUNPOWER: The heat's on for real

After a lot of talk, actual solar-powered heating and cooling units are now on the market. Here's a rundown on the latest—and how to tell if they're really for you.

by Richard F. Dempewolff



Stylish Homan house in New Jersey proves solar homes don't have to look like greenhouses. Array of collector panels angled across front has handsome look of large picture windows. Typical panel, devised by solar pioneer Harry Thomason, is shown at left, below. Water flows down corrugated aluminum troughs, is heated by sun, piped to 2000-gallon storage tank (below, right).

Solar houses are not "on the way"; they are here. Right now, some 108 occupied buildings in this country contain operating solar heating and/or cooling systems.

At a recent conference sponsored by the Solar Energy Industry Assn. in Washington, D.C., 5000 people wandered through exhibits of several dozen manufacturers of solar heating and cooling systems. Displays ranged from vast solar collector arrays for commercial buildings to back-yard solar furnaces (page 102, Feb. '75) and assorted new collector designs for residential dwellings, swimming pools, water heaters and the like. Several were adapted for do-it-yourself installation.

That's not all. As you read this, a California builder, Terrence Caster, is developing a new subdivision outside San Diego containing 22 homes heated entirely by flat-plate solar collectors invisible from the street. The collectors have aluminum fin absorbers with copper tubing to pipe sun-heated water to a storage tank. Forced air circulates the stored heat through the house as needed. The builder estimates the additional cost at \$3000 to \$6000 depending on size and type of house, and anticipates



fuel savings of 50 up to 90 percent.

In June, work began on a group of sun-warmed ski lodges in Vermont's Quechee Gorge. A little farther south, construction has begun on Grassy Brook Village, the nation's first solar-heated condominium complex.

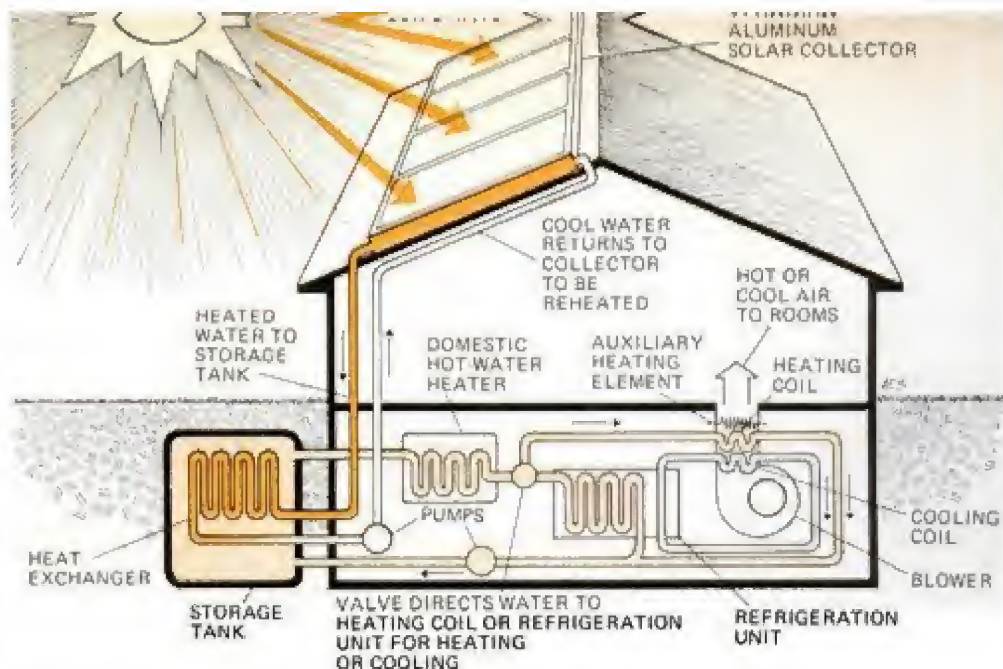
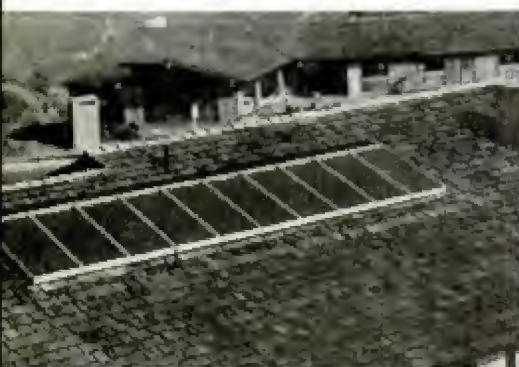
The list goes on and on. To top it off, last year Congress passed the



Solar Heating and Cooling Demonstration Act, providing funds for the development of solar heating and cooling systems. It is expected to result in the instant creation of up to 4000 new solar homes, estimate officials at the Energy Research and Development Administration (ERDA).

Among the new approaches in solar homes is an effort by architects to give the massive and often ugly collector area eye appeal. In Cambridge, Mass., a firm called Mass

One of newest absorber plates, made of aluminum extrusions that form tubes with fins attached, is development of Aluminum Assn. In glass-covered roof panels (below), rows of finned tubes are warmed by sun. Water circulates in tubing, is collected and stored to heat and aircondition house (diagram at right).



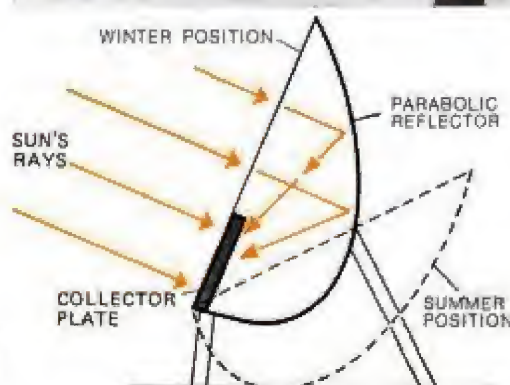
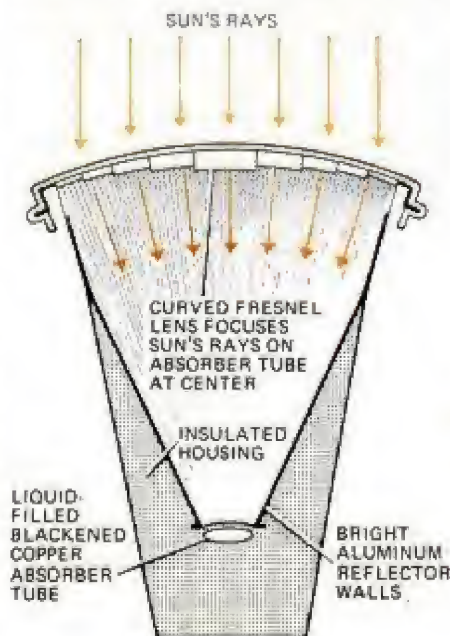
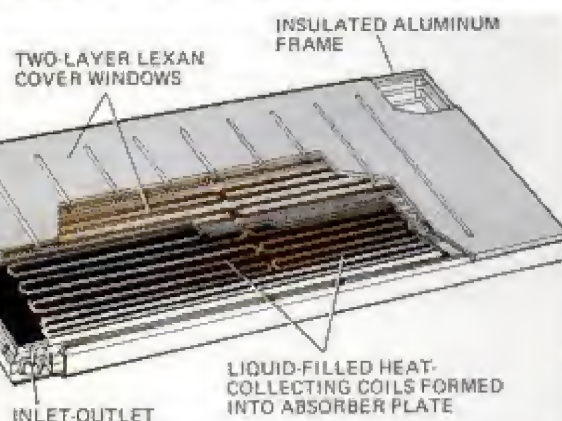
Design has worked out plans for solar-heated New England homes aimed at maintaining the design integrity of "Cape," "saltbox" and other colonials.

As more new solar homes go up, the better looking they become. Robert Homan's new solar-heated house in Indian Mills, N.J. (shown on preceding page) typifies the trend. Architect Malcolm Wells incorporated 680 square feet of "open flat plate" collectors into the contemporary design, yet they have none of the "greenhouse look" of earlier solar homes. The 4 by 7-foot units employ a single sheet of corrugated, blackened aluminum beneath a glass cover. Water cascades over the open surface of this absorber, picking up heat as it goes. It is collected in a trough at the bottom and carried to a 2000-gallon storage tank surrounded by 30 tons of brook boulders. Heat, as required, is siphoned off by forced air through the warmed stones. The "open flat plate" concept was devised by a pioneer in the business—Dr. Harry Thomason—in the '50s and is still one of the simplest and cheapest (if not the most efficient). Today, the panels can be bought for about \$4 a square foot from Edmund Scientific Co. of Barrington, N.J. In the Homan house, Edmund added a power windmill that provides electricity to run the system's water-circulating pumps.

Many new solar home projects involve highly innovative techniques for trapping the sun's warmth. In Manchester, N.H., Kalwall Corp. has built a prototype house with a wall of clear, double-glazed fiberglass panels that are called Sun-Lite. The material lets solar heat in, but keeps it from escaping back out. The panels cover 12-inch-diameter cylinders of Sun-Lite as high as the wall. These are filled with water and function

Other types of solar collectors

Solar collectors are constantly growing in sophistication and now come in wide range of types. At top below is GE system with closed circulation coils imbedded in absorber plate covered with double-layered "window" to trap in heat. At middle right, Corning uses vaned pipe in vacuum-sealed glass tubes to keep heat loss low. Vanes tilt to catch best sun angle. At bottom are two "concentrator"-type collectors. In Northrup's at left, curved Fresnel lenses focus intensified sun heat onto an absorber tube, and the entire collector swivels to track the sun. At right, Falbel uses parabolic reflector to concentrate additional sun energy on back side of collector.



both as heat collectors and storage tanks at the same time. Fans force air through the sun-warmed cylinders, circulating heat through the house. The system, by eliminating separate collectors and storage facilities, reduces heat losses from the usual heat exchange to storage. Its efficiency and economic potential look promising.

Another unusual house, near Manchester, N.H., has Sun-Lite panels covering a south wall of 12-inch-thick concrete. The black-faced concrete soaks up and stores heat. Ports in floor and ceiling control heat flow into the building. During periods of little or no sun, and at night, tiny plastic beads are blown into the space between the double-glazed Sun-Lite panels, preventing the escape of stored heat in the concrete. Come the sun, the plastic beads are sucked out by vacuum pump and dumped into storage canisters until needed again.

A list of who makes what in solar equipment is available in the *Solar Energy Industry Directory and Buyer's Guide*, published by the Solar Energy Industry Assn., 1001 Con-

pared to about 80° F. to 200° F. for most conventional flat plate collectors. Another advantage: The banks of tubes need not be angled directly at the sun; they can be part of a vertical wall, each tube rotated so the absorber fins catch sunlight—like louvers of a Venetian blind.

In Texas, Northrup, Inc. has come up with a trough-like arrangement covered with a long, curved Fresnel lens that focuses the sun's rays on an absorber pipe filled with liquid. The device swivels to track the sun. Collector temperatures can be maintained at a steady 200° F. for absorptive-type airconditioning.

One of the wildest new ideas is Falbel Energy System's parabolic reflector. It reflects sunlight to the rear surface of a flat plate collector. At the same time, the collector picks up sunlight directly striking its front surface.

With all the excitement, where do you begin if you're interested in checking out a possible conversion to solar energy? There's some reason for concern. Virginia Knauer, Special Assistant to the President for Con-

spent \$1000, you can afford \$5000 amortized over 10 years for a solar system. If you spent \$500 or less, you will save nothing on sunpower at current prices.

2. What size and type of collector panel will you need? First, convert the heating fuel you consumed during the last heating season to the B.T.U.s it produced. Here's how to find this figure: If you heat with electricity, multiply the KWH consumed by 3413; if oil, multiply the gallons consumed by 133,300; if gas, each 100 cubic feet of gas produce 104,000 B.T.U.s.

(Note: For electricity and gas, eliminate the amount used for purposes other than heating. To do this, simply check the consumption for summer months when heat is off, project this amount for the year and subtract it from the total used. The remainder will be the amount consumed for heating.)

3. There are three basic collector types for peak load home heating:

Open flat plate. Advantages: low cost (\$3.50 to \$5 per square foot), easy to install and service, good in milder climates. Disadvantages: inefficient, limited by heat loss through condensation on glass cover, especially in cold climates.

Closed flat plate. Advantages: higher operating temperatures, hence more B.T.U.s per square foot of collector per dollar of cost. Since water is circulated through coils, there's less corrosion and easier maintenance. Disadvantages: higher cost (\$7 to \$10 and up per square foot); more sophisticated plumbing to install; possible steam buildup and clogging.

Focusing concentrator. Trough-like collectors using lenses or reflectors. Advantages: simplicity, easy back-yard installation in some cases, high operating temperatures. Disadvantages: high cost (\$10 and up per square foot); poor aesthetics, often bulky, awkward construction.

4. How big a collection area will you need to heat your house? Here's where the B.T.U.s come in. Each collector's maker should have published data on the B.T.U.s his unit produces per square foot per heating-season month in your area (10,000 B.T.U.s per square foot per month is theoretically available in temperate mid-U.S. climates, but 3000 to 4000 may be closer to reality). If the salesman hasn't got that information, try another brand. Your collectors must produce the same amount of B.T.U.s your present fuel provides to warm your house. There's also a rule of thumb to determine approximate collector area for peak load heat production in areas of

(Please turn to page 119)



Decade 80 House, experimental solar home of Copper Development Corp., features sprawling, irregular layout to break up appearance of its many copper-coil roof collectors. System also heats attached swimming pool.

necticut Ave., Washington, D.C. 20036. An even more definitive 650-page catalog of solar products, research companies and legislative data is also available—at \$20—from Environmental Action of Colorado, 2239 East Colfax, Denver, Colo. 80206.

Some new solar collector concepts are unique. On the roof of a laboratory at the Corning Glass Works in Corning, N.Y., arrays of 8-foot evacuated glass cylinders are stacked in horizontal banks. Black-finned copper pipe snakes through each of the tubes, carrying heated water to storage. The vacuum prevents the escape of heat soaked up by the absorber fins, so working temperatures run as high as 250° F. to 300° F., com-

sumer Affairs, recently quoted an expert's observation that: "There are numerous individuals and organizations right now who have begun marketing solar systems of questionable quality . . . whether through negligence or outright fraud . . ."

"My office," said Mrs. Knauer, "will do its utmost to both promote manufacturers of integrity and warn the public about flim-flams and how to spot them." Kevin Moran, newly appointed product engineer for Edmund Scientific Co., a man steeped in solar energy studies, has some sound, objective advice on the subject:

1. Accurately figure the cost of your heating fuel last season. If you



Showing off their tricks are (top to bottom): Heathkit alarm, indicating interrupted power, Heath car clock, Aries rally timer car clock (smaller numbers show time), Micronta alarm with raised button showing alarm is on, easy-to-build Digital Concepts Datachron that shows date when you press the top button.

Digital clocks get slicker, sleeker, trickier

And the kits are easier to build.

by Ivan Berger
ELECTRONICS EDITOR

Digital clocks can show you the exact time faster (no squinting to see if it's 11:32 or 11:33)—but "analog" clocks (the standard dial type) show you the approximate time at an even faster glance, and let you judge elapsed time with a quick mental image of moving hands instead of adding or subtracting time by mental arithmetic.

All-electronic clocks are at least potentially more reliable than clocks with moving parts, and they're about equally accurate. But they're expensive enough to more than offset any advantage in reliability. Still, the latest crop of digitals have some other appealing features, too.

Heathkit's new GC-1092A clock (top of facing page), for instance, has two gimmicks designed to cope with power interruptions: If you insert three AA batteries (a trickier task than it should be), the clock chip will go on marking time and the alarm will function until the power's restored, though the power-hungry displays will stay dark. You can even wire it to keep nickel-cadmium batteries on constant trickle-charge. And if the batteries are out or dead, the clock will display all 8s, as shown, once power resumes so you'll reset it. The Heath has other cute features, too: a tiltable base that's removable if you prefer a low profile (though the alarm—a bottom-mounted speaker—is hard to hear when the clock's bottom rests directly on a surface); switch-selected 12-hour or 24-hour time display; an a.m./p.m. indicator in the 12-hour mode; and a sleep switch that lets you

snooze 10 minutes more if you just touch the nameplate on top of the clock. It takes six or seven hours to build and costs \$83, as does a calendar-clock version without alarm.

Radio Shack's \$40 Micronta No. 63-810 also has snooze-alarm, and shows a raised alarm switch button (see photo) when the alarm's set. It's "seconds" display is small for less distraction, and you can shut the seconds off altogether. The design is very sleek, with both built-in, folding stand and a key-slot for wall-hanging. And it's compact enough to carry with you as a travel alarm.

Digital Concepts' CK-131 calendar clock has a choice of 12-hour and 24-hour time-telling, and also displays 8s when power is interrupted. It can be switched to display only time or date, or to alternate between them every 10 seconds. In time-only mode, a touch of the button on top calls forth the date (Heath's calendar clock works the same ways). The kit is one of the easiest I've ever put together—easier even than Heath's, which is a high compliment—thanks to such nice touches as parts prepackaged in separate envelopes for each page of the manual, and components with their leads already bent. The kit, with wood cabinet, is \$60; the battery-insurance feature is extra for under \$1. (Heath's is \$83 in plastic, but includes the battery-insurance feature.) The Digital Concepts clock is also available, without cabinet, as the CK-100 for \$48. Assembled, it's \$75, either as shown or with a clear face that lets you see its electronic components.

My own favorite digitals, though, are the car clocks. It's while driving that I most appreciate being able to read time with a single glance. Heath's GC-1093 does that nicely, with perfect accuracy (it has neither gained nor lost a minute in three months of operation). It has built-in a.m. and p.m. indicators and a circuit that dims the display when the light

inside the car is dim, to prevent glare (Heath's alarm also does this). And it turns the power-hungry display off when you turn off your ignition. A separate circuit measures elapsed time in minutes and seconds to 10 minutes, then in minutes and hours to 20 hours. Both timing functions run at once, and you can read either at the flick of a switch. The Heath is easy to build (it took me one long evening), and easy to mount above or below the dash using either the gimbal bracket or double-stick tapes supplied. It's \$65. Heath also makes a matching, digital tachometer for \$50.

The Aries, though it tells time, is basically not a clock but a rally chronometer. Its time display is small ($\frac{1}{8}$ -inch high), while its elapsed-time indicator, which is visible at the same time, displays minutes and hundredths of minutes. It takes five hours to build (about the same as the Heath) despite poor instructions, and sells for \$140 in kit form, \$170 wired. A plain clock version, in more compact case, is \$70 as a kit, \$100 wired. Instructions, though, aren't quite up to Heath's high standard, and assembly is a bit more complex. ★★



Heathkit car clock tells time and up to 20 minutes of elapsed time, fits neatly above the dashboard as shown, or below it.

Go-anywhere fliers of the ferry service

Ride with a PM reporter as he recounts the adventures of these unsung pilots who'll fly anything, anywhere, under any conditions—and usually get it there.

by James M. Liston

Gasoline-drenched pilot of downed AGcat races for water-filled ditch in fear of fire. The crop-duster crash-landed in a Mexican field, rupturing fuel tank. Buddy pilot circles low above in a Thrush to check scene.



"Cessna 31416 Victor, cleared for takeoff," says the controller at Wichita Municipal Airport. It's 7:45 a.m. The little 100-hp plane responds to the throttle like a frisky colt and leaps into a deep blue sky. The Cessna 150 is what might be called the VW of light planes. This one has only 1.5 hours showing on the engine's hour meter and is fresh from the factory.

We start climbing eastward. Beneath us is Cessna's Customer Delivery Center where I've spent the last few days getting acquainted with a rare breed of men called ferry pilots. One of them, Ron Bredehoft, 29, is at the controls of our Cessna 150 and his job is to deliver it to the Cessna distributor in Morristown, N.J., 1250 miles away. Because this plane cruises at a relatively slow 120 mph, it looks as if it may have to be a two-day trip—not to Ron's liking since that would mean the cost of an overnight stop.

Although he has flown this route almost 100 times, Ron talks about what lies ahead today with the enthusiasm of an office worker off on a holiday jaunt. He works for a Wichita engineering company, but this is a busman's holiday because he's also the company pilot. He's a former Air Force fighter pilot who has flown

F-105s, so isn't ferrying a slow plane pretty boring?

"There are worlds of differences in flying. In the Air Force, flying is regulated by orders. In these little planes you're on your own. There's a challenge to it. Any time you fly a little 150 to New Jersey you've got about 13 hours and you know you're going to have weather *someplace*. Often you arrive about 7:00 at night. In winter, it's already dark, and in the East you can expect something to happen with the temperature-dewpoint. You can get into fog. You may get zero visibility. This kind of flying is where it's up to you and your initiative to keep out of trouble. It isn't boring; it's real flying."

About 300 other U.S. ferry pilots think the same. There are 10,000 to 15,000 private aircraft produced every year. Nearly all are sold "fly away factory," which means the buyer or dealer flies it home or pays to have it delivered. With sales of small planes zooming, even part-timers like Ron, who ferries only on weekends, are kept busy.

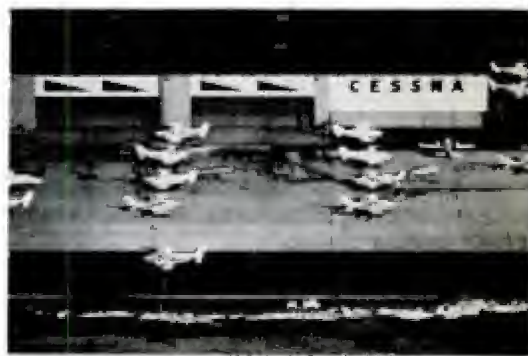
Ferry pilots work for ferry ser-

vice companies. Ron's employer is Air International Delivery Service (AIDS), operated by veteran ferry pilot Wayne Sperling. When a buyer wants a plane delivered, he contacts AIDS. Wayne deducts his 20-percent commission, assigns the job to one of his pilots and hands him the rest of the fee. From this the pilot must pay for all his fuel, food, lodging and return fare by commercial airline. If all goes as planned, he can make some money. How much money?

"About \$50, if I get this plane to Morristown today. When I can go right from there to Lock Haven, Pa., and fly a Piper to Baton Rouge, I can make up to \$350 because I don't have to pay all that airline fare."

Wayne's pilots make between \$600 and \$800 a month, but many supplement this by working as crop dusters or at other jobs, as does Ron. How well AIDS pilots do financially depends largely on Wayne Sperling's ability to bid successfully on a contract. When a customer requests a bid on delivering, for example, a Cessna 421 to Malaysia, Wayne must take into account the gas consumption rate per hour of the plane, the average speed and total mileage, the cost of gas in various parts of the world, the pilot's fee (12 cents per mile overseas rate) plus \$40 to \$50 expenses per day, fees for clearances in the Philippines, and the return

Art: Ed Valigursky



Cessna plant in Wichita where new planes await delivery by ferry pilots to buyers.

fare. If he bids too high, someone else gets the job. If he bids too low, his men lose out. But Wayne knows his business; he's a ferry pilot with almost 10,000 hours.

We land at Jefferson City, Mo., refuel, gulp a cup of coffee and are off. "We have 30 knots on the tail right now," says Ron, "and we'll be getting 50-knot tailwinds over St. Louis. At this rate, we may make it in one day. This morning we got a forecast of perfect weather all the way, so I left my instrument approach plates for the New York area at home. That may have been a mistake. If there's weather east of Indianapolis, we'll have to do the best

we can VFR (Visual Flight Rules)."

Ron requests weather for Indianapolis and Ohio and there is something shaping up.

"The Alleghenies angle right across our path," muses Ron. "I don't know what weather they have there yet, but Dayton has 1200 feet overcast and Columbus 500. It's getting worse as we go east."

We skirt the north side of St. Louis and lunch on thin, dry sandwiches we picked up in the Jefferson City airport. I'm reminded of Wayne Sperling saying: "We'd rather fly than eat." (Ferry pilots miss a lot of meals.) But as Norm Clothier, a 53-year-old ferry pilot, says:

"Where can you get a better deal? They give you a new plane and pay you to fly it. It's a great way to see the country. I've seen every state but Maine from the air."

"If it's flying experience you're after, you'll get it," says Tom Flynn, who runs his own ferry service like Wayne's.

What about hairy experiences? They all claim this part of the business is exaggerated, but each one has a few stories. Wayne Sperling had a Commander Thrush (a crop-duster) blow an engine over a swamp in Mexico.

"I walked away from that and came back later to put in a new engine and fly it out. We had our pilot Bob Dodson go down there in a Grumman AGcat (open-cockpit crop-duster) to fly with me in case the Thrush gave us more trouble. I got it out of the swamp all right and was climbing out of Vera Cruz when I see Bob

It looked like fun at first as Bahamian military P-51s buzzed three Cessna AGwagons being ferried to the islands. But the fighters forced the crop-dusters to land until their mission was straightened out. The American pilots were later freed—after a good scare.

ahead of me nose down and waggle his wings—sign of trouble. He tries for a clearing, but his right wing hits a palm tree and the AGcat spins like a top. It has 200 gallons of gas in the chemical hopper. You might say sitting in the pilot's lap. When he hit, this gas came right back over him. I saw him running, tearing at his clothes, and he jumped into a ditch and splashed water on himself. He wasn't on fire, but he was drenched with gas. He came out of it okay."

"Excitement? We had a little last year," says Ron as we fly south of Effingham, Ill. "Wayne, Tom Day and I were delivering three crop-dusters to the Bahamas. We're flying in a loose formation on Wayne's

were trying to give us a good scare, they did."

We have a tentative plan to refuel at Zanesville, Ohio, then fly across the mountains to Johnstown, Pa., Harrisburg, Allentown and on to Morristown. Then comes the reply to Ron's request for weather:

"Johnstown, ceiling 400, visibility three-quarters of a mile, light snow

Flying the mountains of South America requires no compass, joke ferry pilots—you just follow the peaks. Here two Cessna AGwagons play tag with craggy spires on way to Bogota.



wing along those beautiful beaches when suddenly a P-51 whizzes by. We all think that's pretty and watch him circle in the blue. But he comes by again and drops his landing gear, the signal to land. Then another P-51 joins him. So we land. They have a jeep with a machine gun pointed at us. We filed a flight plan, but apparently it wasn't forwarded to the Bahamian government, recently skittish about illegal entries. Eventually they let us go, but if they

and fog. The Johnstown airport is closed. Allentown, 500 overcast, visibility one mile, light freezing rain and fog."

"Not good," says Ron. "We'll go into Columbus and check."

We land, refuel, get lukewarm results from the coffee machine and a muddy forecast from the Telex.

"Let's see how far past Zanesville we can get." We leap off the runway and hunker down under broken clouds at 1500. Buffeted by gusts,



we bounce and rock our way over eastern Ohio like canoeists bobbing over rapids—Zanesville, Pittsburgh, Latrobe, Pa.

"This may be as far as we get tonight," Ron says as we begin our approach to Latrobe. In the somber twilight we can see great banks of clouds build into a solid rampart from north to south across our planned flight path. Beyond Latrobe rise the first ridges of the Alleghenies.

"Cessna 416 Victor: Runway 8 has been sanded. Braking action reported fair. Clear to land."

"Looks like we've had it," says Ron, peering out an airport window at the sky. "But if we stay here tonight we may be stuck all day tomorrow. Weather fronts pile up at the foot of those mountains and sit here. Before settling for a motel, let's just fly up north a bit and have a look."

He flies with his right hand on the throttle, the left resting on the yoke, holding the chart. I recall Len Organ of Cessna saying:

"The professional ferry pilot has to be better than the airline pilot. He doesn't have a lot of people and equipment backing him up. It takes

a lot of flying ability to fly the Alleghenies. A lot of planes have gone in there. It used to be called the 'grave yard' in airmail days. Pilots try to scoot under an overcast to get through there and they don't make it."

Ron checks the chart and outside temperature and studies the buildup, looking for an opening. There is none. "No use," he mutters.

We do a 180 and head back toward Latrobe. But he pores over the chart and frowns. He checks the temperature again, draws back on the yoke and we climb. The compass rotates until we're heading due east.

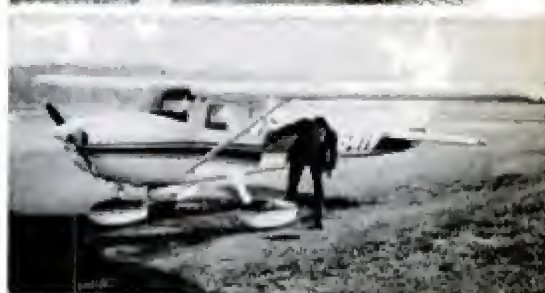
"Let's just look . . . over this first ridge."

Ron flicks on the landing lights to see what we're getting into. A lot of blackness, but at least no fog. He clamps his thumb on a point on the chart and stares ahead. Suddenly he exclaims: "There!"

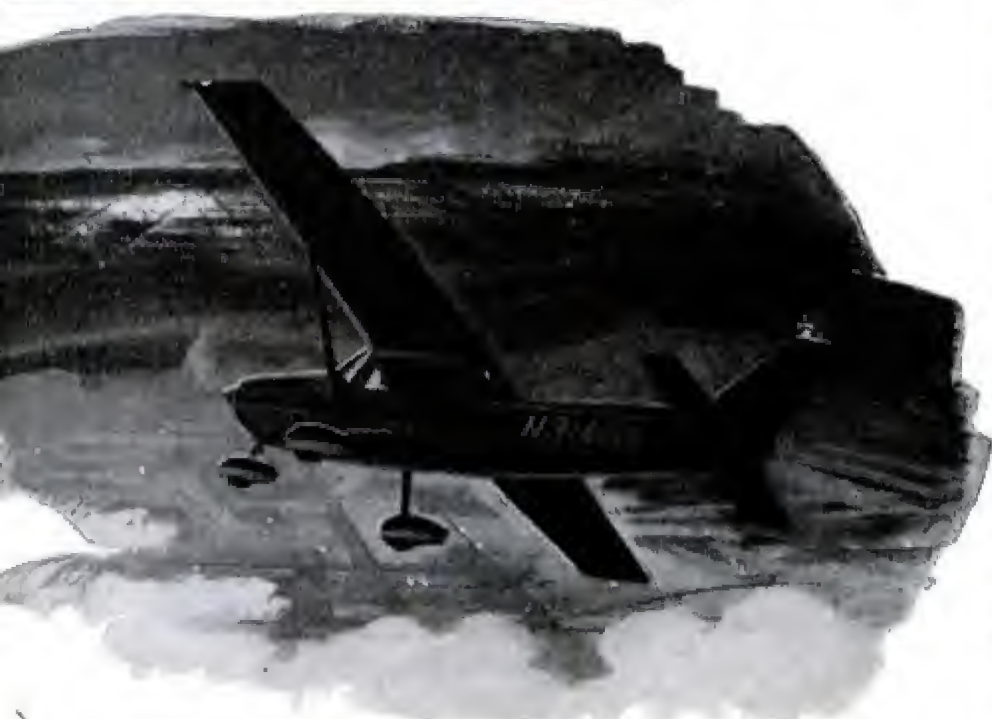
The dark veil in front of us drops away and we see the ridge, then the next ridge, and the next, all the way across the mountaintops.

"We're in the clear! That stuff is piled up in front of that first ridge.

Pilots in chart room at Wichita check weather and routes before takeoff. At bottom, ferry pilot Ron Bredehoff looks over new Cessna he will deliver to a customer.



Faint glow in distance—the lights of Harrisburg, Pa.—indicate that author and his pilot have safely skimmed over last threatening ridge of the Alleghenies. Map shows the route of little Cessna 150 as it detoured northeast to skirt mountains, then doubled back to squeak over the peaks near Altoona just before bad weather closed in.



We have a temperature inversion so we don't have to worry about icing. It's warmer up here than when we took off. See that very faint glow out there? Harrisburg."

He had worked it out patiently like an involved math problem. No wild guessing. No taking chances. No heroics. The clearance between the overcast and the top of the ridge—about 1000 feet—was carefully calculated and just enough to let us slip safely through. It was the kind of professionalism that's typical of ferry pilots.

Of course, sometimes there's a little of the old seat-of-the-pants flying, too. There's the story Wayne tells:

"Biff Adams and I were delivering two AG wagons to Bogota, Colombia. Somewhere around Vera Cruz my compass went out, but Biff and I decided to go on anyway. When you leave Panama, you don't need a compass. Those mountain peaks are sticking up and you know where you are. We flew into Bogota and went to dinner. A Pan Am engineer joined us. He couldn't believe we'd flown down without instruments or a radio

(Please turn to page 119)

Take race engines that can average over 100 mph hour after hour in enduros. Polish and beef them up into production models that will handle big hulls as well as hydros. Push up their power without boosting fuel consumption, size or noise, and you'll have a preview of some of the big new outboard motors on the way for next year.

Evinrude gets 200 horses out of its biggest one. So does Johnson. Mercury is coming through with Black, Max, its new V6 muscle machine that hides a herd of 175 under a cowl smaller than that of the Merc 1500—this year's 150-hp model. The jumps in power are dramatic. Mercury's top for 1976 is up 25 hp, while the Outboard Marine duo, Johnson and Evinrude, have gone up 65!

Chrysler has concentrated on engineering refinements and kept power ratings of its big ones at 135 for high performance, 150 for the limited production racing mill. Volvo Penta will run from 70 hp down to a new 3.9, with all nine models mounting an alternator.

Who needs 100-plus horsepower on the back of a little outboard? Owners of bigger boats, according to builders of the bigger motors. Those 20-foot-and-over offshore fishing rigs, outboard cruisers, big pontoon craft, houseboats and the rest should all be able to take advantage of the extra push, and should save gas as well at moderate throttle settings. The Evinrude and Johnson muscle machines will displace 149.4 cu. in., and mount twin fuel pumps, three-barrel carbs and tuned exhausts. Extra-long shaft (25-inch) lower units will be a useful option.

Mercury's descendant of its Twister T-3 racing machine has 122-cu.-in. displacement, and a number of novel features we'll try out for PM's Black Max performance test next month. A selection of 12 power categories will stretch from this new Merc 175 down to a new four-horse fishing and small-boat special that will weigh in at only 36 pounds.

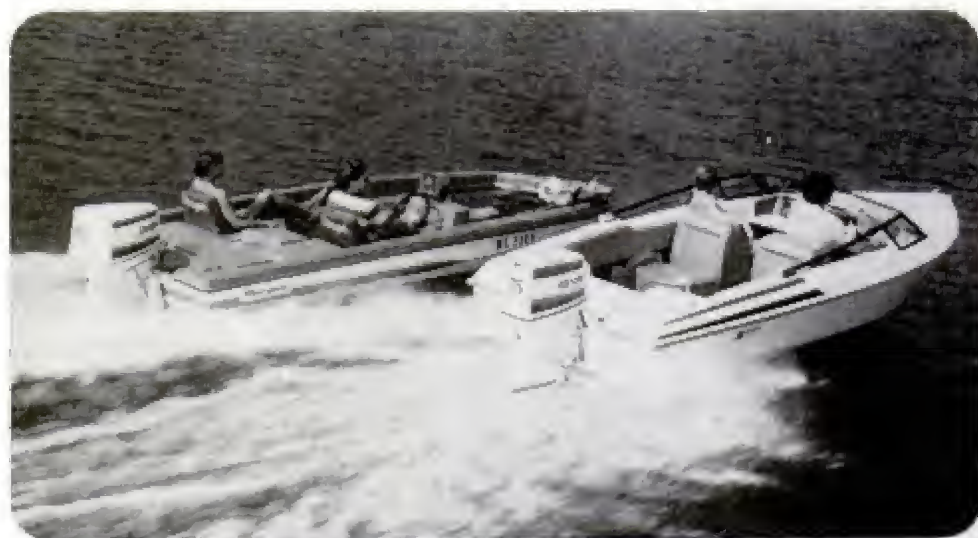
New Johnsons and Evinrudes include a 35-hp mid-range motor claimed to be compact enough for easy car-trunk carrying. Johnson's Sea-Horse 55 replaces this year's 50, and has a specially styled V4 85-hp Javelin and three-cylinder 75-hp Stinger. Evinrude also will up its 50 to 55 and offer it in standard and sport models. Sport option styling is offered for the Evinrude 99.6-cu.-in. 135-S and 75-S as well, with silver finish trimmed in red, white and blue.

But 200 horses of power is the biggest outboard news for our Bicentennial anniversary. ★ ★ ★

New clout for next year's kickers

Maybe it's just coincidence, but makers are dishing up some amazing 200-hp outboards for the country's 200th birthday.

by Bill McKeown
BOATING EDITOR



Sport-styled 85-hp Javelin on the Ranger bassboat and 75 Stinger on the Steury (top) are Sea-Horse Johnsons for '76. Other models range down from 200 hp through a redesigned 6-hp twin-cylinder with reported 20 percent gain in thrust to the smallest at 2 hp. Large and small Mercurys (center) are fishing favorites, with Merc 1150s on offshore SeaCraft and Merc 450 for skiff. Merc's new light 4 hp will be available this winter. Fingertip tilt of big ones like Evinrude's 135 on Wellcraft Airlot (right) is possible with new twin nitrogen-charged shock absorbers claimed to cut the lift effort in half.



We'll spare you the crime statistics. Suffice it to say that burglary remains a serious problem in city, suburb and, according to farmer friends, even in the country.

Security measures, including quality locks on doors and windows, may not stop the determined housebreaker. Dogs, too, have been known to prove less than effective in confrontation with intruders.

There is a third line of defense, however—and that's what the 10 hiding places shown on these pages are all about. The idea is to outwit the thief by secreting as many of your valuables as possible in unlikely places: the soffit above the kitchen cabinets or the space behind a baseboard. Even a dummy electrical outlet can serve as a good repository for watches, jewels and other small items.

The 10 places shown by no means exhaust the possibilities for subterfuge. Your house or apartment may contain other features that would make for ideal caches. Look at your abode with an objective eye—and think sneaky!

Remember, you're matching wits with a potential intruder who has a limited amount of time to grab what he's after. Obvious loot—the portable TV or stereo, or cash on top of a dresser—will catch his eye.

SOMETHING TO HIDE?

10 good hiding

by John Pearson and Harry Wicks

Even if he's read this article—and we doubt that *PM* has much of a readership among housebreakers—he would still have to mount a time-consuming search to find that special place—or places—where you've hidden your coin collection and sterling while you and your wife enjoy a weekend away.

If you want further tips on the art of being sneaky, you can find them in *How to Hide Almost Anything* by David Krotz; published by William Morrow & Co., \$5.95. ★★★

Illustrations: Howard Befelson



FALSE SCREW
(GLUED IN)

3/4 x 6 x 18"
PINE BOARD

3/4" DOWEL,
4" LONG
(4 REQ'D.)

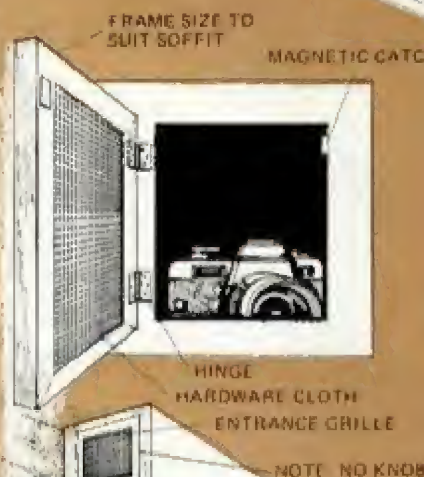
3/4 x 3/4 x
14-1/2" CLEAT

BOTTOM SHELF
PLASTERBOARD

STUD TOP SHELF

MAGNETIC
CATCH
(2 REQ'D.)

1 Fake hatrack hides a hole in wall for jewelry and other small valuables. Cut the hole between wall studs and force-fit lengths of 2x4 above and below the opening to serve as header and shelf. Secure with finishing nails. Rack rests on a cleat, is held by magnetic catches. For authenticity, add a lightweight hat.

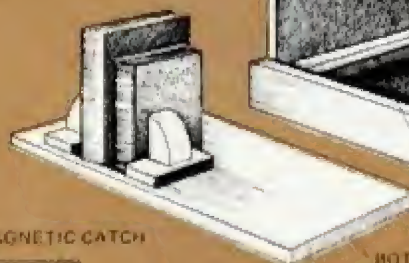


HINGE
HARDWARE CLOTH
ENTRANCE GRILLE

NOTE: NO KNOB



2 By creating a door to look like a vent, space between cabinets and ceiling serves as a "safe." Use hinges that don't show; hold frame in with magnetic catches. Don't use a knob.



FRAME SIZE TO
SUIT SOFFIT

MAGNETIC CATCH

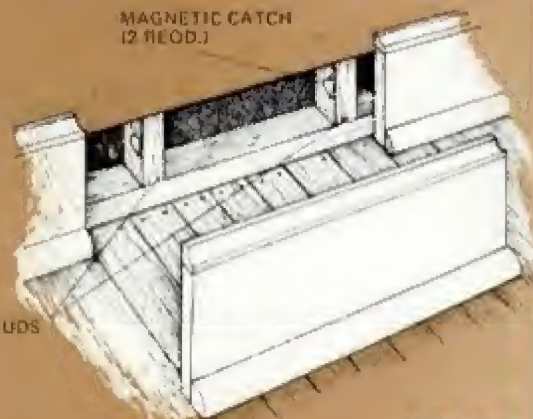


3/4 x 3/4" CLEATS, 4 SIDES

BOTTOM SHELF

3 Logical spot for valuables is beneath bottom shelf in a bookcase. Cleats supporting shelf, installed with 1 1/4-in. screws, are placed so shelf extends slightly above cabinet base for easy removal. Stock shelf with books.

MAGNETIC CATCH
(2 REQ'D.)



STUDS

4 Dandy place for small-size keepsakes—behind a section of baseboard. Space is limited by width of base; thus, this idea is best for older homes with 1x6 baseboards. Magnetic catches hold "door" in place; to hide joints of cutout section, place furniture in front of this hiding place.

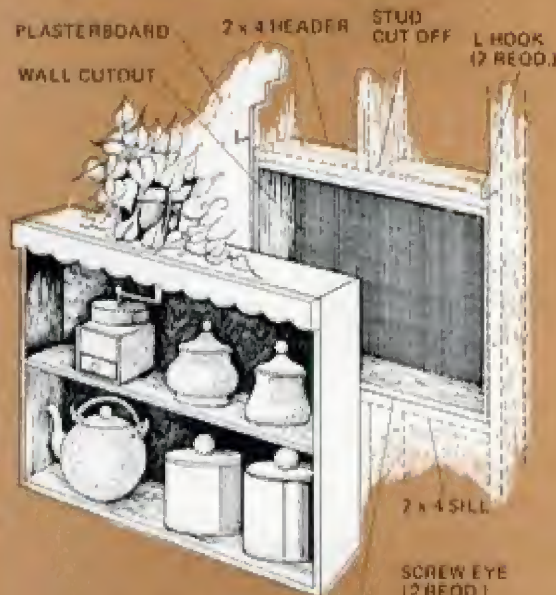
places for your valuables



1/4 x 3/4" CLEAT GLUED AND SCREWED TO UNDERSIDE OF FLOORING



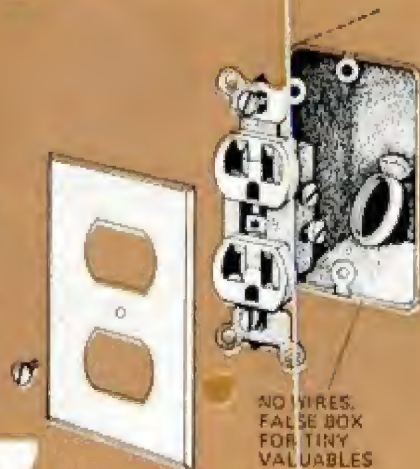
5 In-the-floor "vault" is easy to create, works best in a closet where it can be covered by shoes and the like. Make certain you install the false bottom as shown; weight should not bear on plasterboard ceiling below.



OPENING SIZED 2" LESS IN WIDTH AND HEIGHT THAN SHELF'S OVERALL DIMENSIONS

SCREW EYES KEEP SHELF PLUMB

6 Attractive wall shelf cleverly masks wall cutout behind it. Note placement of four screw eyes on back; a pair must be included at the bottom to hold the box parallel to the wall. To assure concealment of the hole, cut the hole first, then build shelf unit to the desired size.

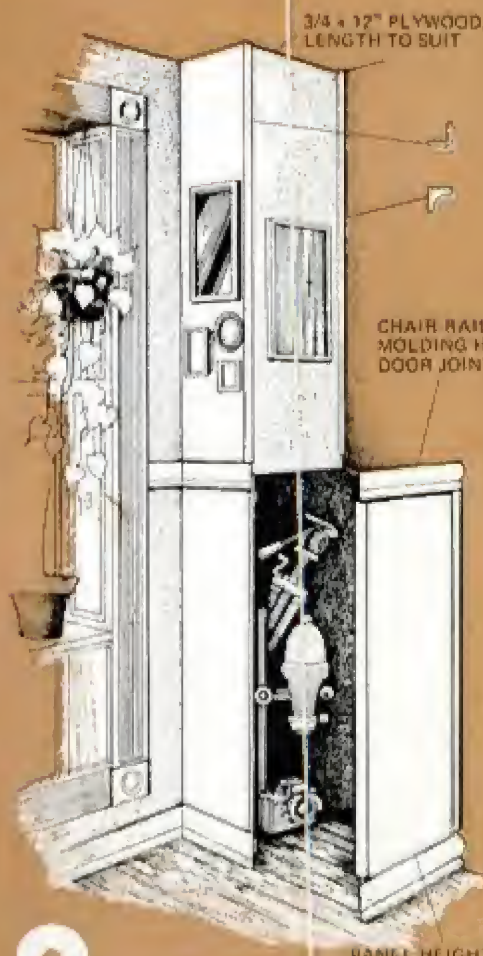


NO WIRES. FALSE BOX FOR TINY VALUABLES

7 Dummy outlet will hold extra-small items such as rings and diamonds. Place it behind a chair or table where a burglar will not be tempted to test it and discover it's phony.



TOOL PANEL CONCEALS BOXED OPENING



3/4 x 12" PLYWOOD, LENGTH TO SUIT

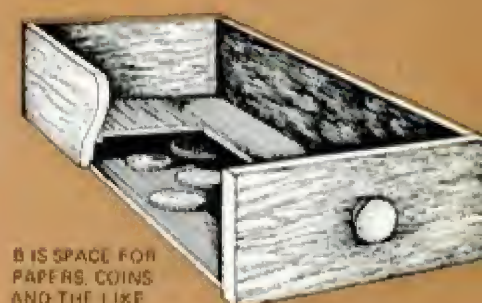
CHAIR RAIL MOLDING HIDES DOOR JOINT

PANEL HEIGHT 42"

8 After jewelry and cash, burglars opt for small appliances, radios, TV sets. You can store such items in a false corner that appears to be a boxed-in chimney. A section pulls out for access. For ease of construction, build the corner of 3/4-in. plywood over a 1x3 furring framework.

OUTSIDE DIMENSIONS AT LEAST 30 x 30"

9 Who'd ever think to look for valuables behind a garage tool-board? The idea here is basically the same as for the shelf hiding place (No. 6). Before permanently mounting the hardware, hold the box in place to make certain it fully covers the framed wall-hole.



8 IS SPACE FOR PAPERS, COINS AND THE LIKE

1/2 x 1/2" CLEAT, 4 SIDES

FALSE BOTTOM, 1/2" PLYWOOD

DO NOT MAKE DIMENSION "A" SUSPICIOUSLY SHALLOW

10 For rare coins and the like, use space underneath false bottoms in drawers. But avoid arousing a burglar's curiosity by making sure that Space A is not too shallow. Valuables that might "clink" when drawer is pulled should be wrapped in noise-deadening material.

Quick-cook burger broiler

This handy hamburger cooker turns out finished burgers almost as fast as a toaster does toast. Drop a mound of meat in the cup, close the cover, and a perfect patty is formed. Cooking times are: one minute, rare; two, medium; three, well done. Jiffy Burger from Sears, Roebuck will also form patties for later use, cook frozen burgers, fry eggs, toast English muffins. About \$17.



Turntables that float on air, or think like clocks

The rotating platter of Stanton's latest Gyropoise turntable (above, left) floats on air, held aloft by magnetic repulsion to prevent bearing wear and vertical rumble. With arm and stereo cartridge, it's \$200; with 4-channel cartridge, \$225. Sony's PS-8750 turntable (above, right) has a quartz crystal oscillator like those in some electronic watches to control its speed to 99.997 percent accuracy and a tone-arm of nonresonant carbon fiber. Now sold only in Japan for about \$600.



Dual phone jack

If you've ever needed to plug two telephone extensions or other telephone accessories into one telephone jack, you will appreciate this new gadget, the Dual Jack-in-a-Plug, from Radio Shack. Plug it in, as shown, and you can plug two more phone plugs into it. It's \$2.29 at Radio Shack stores, or by mail from 2617 West 7th St., Fort Worth, Tex. 76017.



Magnets mix darkroom chemicals

The agitator in this mixer is a plastic-encapsulated bar magnet: Drop it into any vessel holding up to one gallon, set the vessel on the Mag-Mix base, and the bar magnet spins in the grip of another motor-driven magnet, at speeds from 200 to 2400 rpm. This makes darkroom chemical mixing easier, quicker, more uniform. GCA/Precision Scientific, 3737 West Cortland St., Chicago, Ill. 60647.

Instant (almost) wainscot kit

There's no cutting of boards with this precut wainscot kit—you can cover an entire 12-foot wall in a couple of hours. The kit includes 10 16-inch-wide by 32-inch-high tongue-and-groove Marlite planks, a cartridge of adhesive, all necessary nails and clips and two lengths of matching chair-rail molding to cap off the top edge. The prefinished Marlite panels come in four wood tones—Gray Barnside, Light Rough-sawn and simulated pecan and oak. \$39.95. Marlite Paneling, Masonite Corp., Dover, Ohio 44622.



A go-anywhere air-prop craft, exciting Cobra ACV skims land or sea at speeds up to 60 mph. It measures 6½ feet wide, 14 feet long, can carry two persons, has payload of 300 to 600 lbs. depending on engines used. You can build it for about \$600.



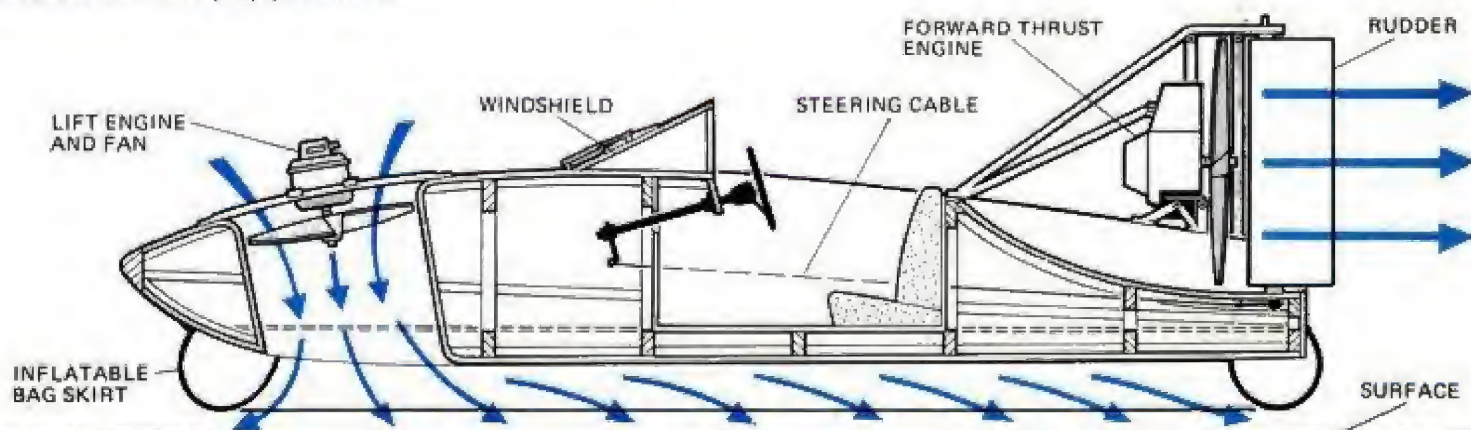
Vertical two-blade prop provides forward thrust; horizontal six-blade prop provides lift.

Build this air-cushion vehicle from PM plans

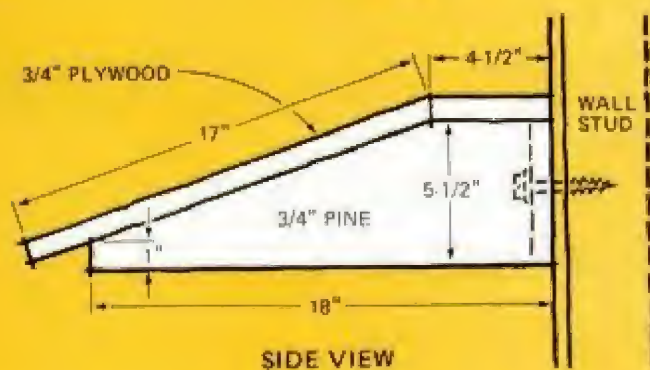
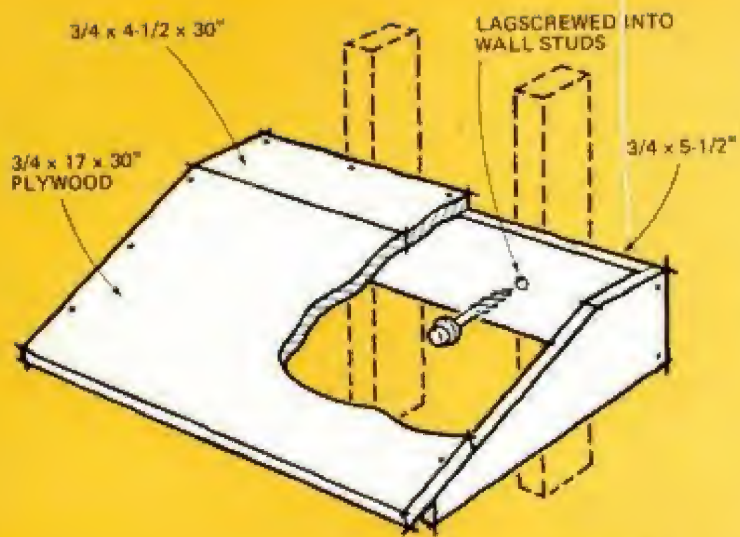
Imagine flying along at great speed over land or sea, sand or ice on a bubble of air 10 inches above the surface. You can experience such a thrilling ride in this air-cushion vehicle for it's a boat, snowmobile, ice sled and dune buggy all in one.

A Chrysler West Bend kart engine with a six-blade prop provides lift, and a 28-hp Kohler snowmobile engine with a 36-inch prop gives forward and reverse thrust. A vinyl skirt around the air chamber beneath the craft traps the downward force of air to lift the hull off the surface. Plans include six big 17x22-inch sheets plus a 16-page instruction booklet. Instructions for ordering appear below.

TO ORDER PLANS AND INSTRUCTIONS for building the air-cushion vehicle, send \$9.95 (check or money order) to Air-Cushion Vehicle, Popular Mechanics Plans Library, Box 1014, Radio City, New York, N.Y. 10019. Please allow two to three weeks for delivery.



Art: Peter Trojan



Two quick projects for the kids' room

Orange-red desk contrasts boldly with wall of Marlite prefinished Roughsawn plank, ties in with accent wall.

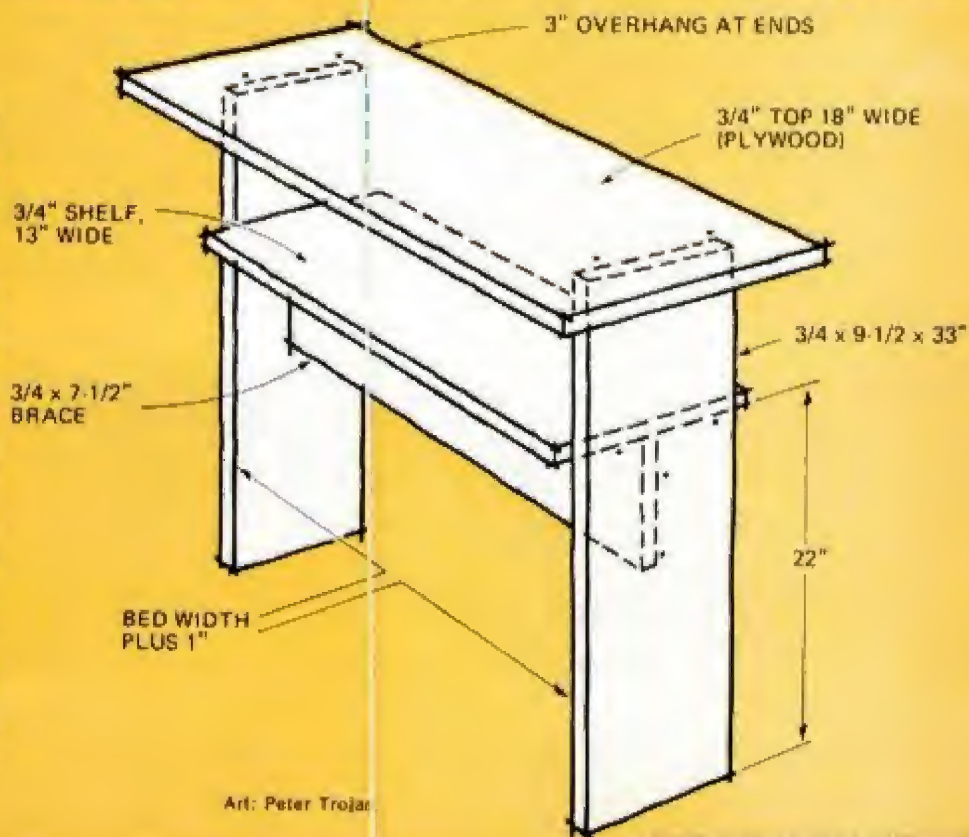




Color of table and headboards is complemented by matching drapes and bed skirts.

One thing about kids' furniture—it's usually simple to make and that goes for this novel wall-hung desk and footboard bed table. Both require little more than a hammer and saw to build. You simply saw the pieces to size, apply glue, nail together, paint and you're done. The job is even simpler if you have your lumber dealer do the cutting for a small extra charge.

The wall-hung desk becomes plenty strong to work on when it's anchored to wall studs with a couple of husky lag screws, and there's nothing underneath to bang knees on or interfere with cleaning. A good height from the floor is about 30 in. The desktop is slightly sloped for easier reading, writing and sketching. The footboard table is made to straddle twin beds placed end to end along a wall. To change the bedding, you just lift the table out of the way. ★★★



Art: Peter Trojan

by Harvey Shaman

Soaring is usually considered a rich man's sport—but not with this little glider you can build from a kit. Priced at a fraction of the cost of a conventional full-size sailplane, it represents a sort of compromise between the big luxury birds and the tiny, much less safe, less controllable hang glider. Its designer, Jim Marske of Michigan City, Ind., thinks it may become the

(Please turn to page 118)

Mini glider you can build from a kit



Photos by the author

Complex wing system above incorporates ailerons at tips, spoilers at mid-span on each side and elevator panels set into trailing edge at center. Vertical stabilizer is fixed, has no movable rudder. Turning and banking are achieved through coordinated use of ailerons and spoilers.



Basic parts of kit-built glider are shown above. Though overall wingspan is 39 feet, individual wing panels are deliberately kept to under 19½ feet long so ship can be disassembled and stored easily in a 20-foot garage. Close-up at left shows cockpit pod with overhead control stick.

IT'S NEW NOW

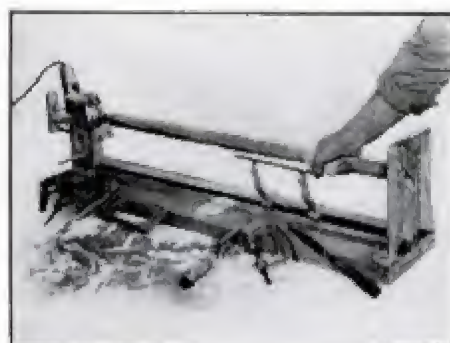


It's a cooler! It's an icebox! It sits either way

The Covey 80-Quart Convertible chest cooler can be used in the conventional horizontal position or stood on the feet molded into one end for upright use. Interior ribs act as dividers for a food storage tray, large plastic box for a block of ice, gallon water jug. Lid and chest are insulated with polyurethane foam; capacity is 2.7 cubic feet, weight 23 pounds. Cooler is available in red, aqua or blue with a white lid; suggested retail price is \$65.55. Covey Corp., Box 1317, Houston, Tex. 77001.

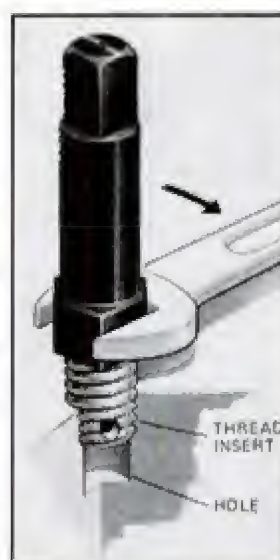
Brass-tipped mallet

For use where steel would mar work, this mallet has replaceable heads of half-hard brass. It comes in two sizes: 3/4-inch-diameter head, 10-inch handle, 7-ounce mallet; 1-inch-diameter head, 12-inch handle, 10-ounce mallet; either size, \$5.95 postpaid. Extra screw-in heads of nylon and vinyl are available. Made by Southwest Mfg. Co., Box 722, Downey, Calif. 90241.



Drill-powered light-duty shop

Using any 1/4 or 3/8-inch portable electric drill for motive power, Basic "C" Drill Press Shop performs variety of small jobs. Drill-press kit is \$16.95 list. Accessories are added for other functions: long lathe kit with faceplate (top) is \$14.50 list; tilt sander kit with accessories (bottom) is also \$14.50. At hardware, department, discount stores. Basic "C" Corp., Box 188, Baroda, Mich. 49101.



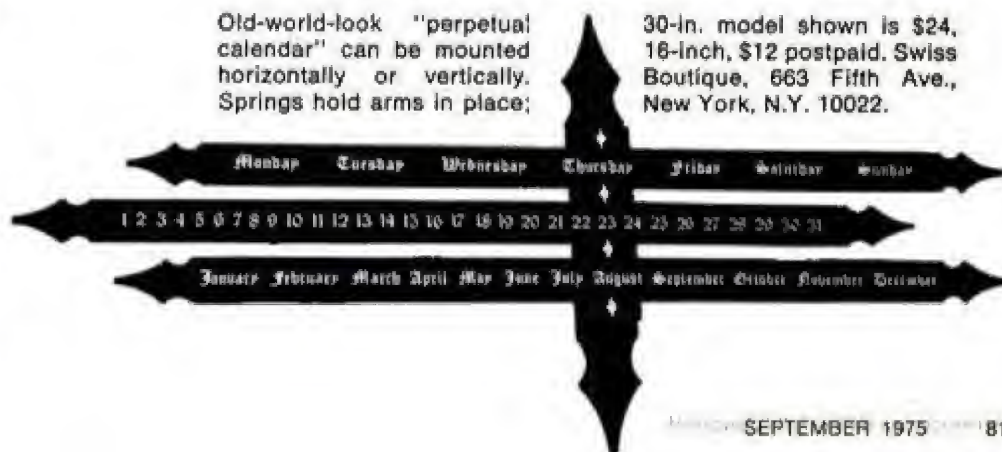
Quick fix for damaged threads

For thread repair in aluminum, magnesium, mild steel, cast iron or plastic, Tap-Lok Repair Kit offers quick, professional results at low cost. Old thread is drilled out, insert screwed into hole with tool provided and tool backed out. Tool shank can be held in tap or socket wrench. Kit for 1/4-20 internal thread, with six inserts, lists at \$10.60. Other sizes available. Groov-Pin Corp., Hendricks Causeway, Ridgefield, N.J. 07657.

Decorative perpetual calendar from Switzerland

Old-world-look "perpetual calendar" can be mounted horizontally or vertically. Springs hold arms in place;

30-in. model shown is \$24, 16-inch, \$12 postpaid. Swiss Boutique, 663 Fifth Ave., New York, N.Y. 10022.



Dial-a-ride: Boom or bust

You can't beat a mass-transit system that picks you up at your front door and costs only two bits—or can you?

by Robert Lund
DETROIT AUTO EDITOR



Photos: Dick Feedick



Pickup points for dial-a-ride systems are in front of your own house. Vehicles used are often vans; This one uses a cap for added headroom (note modification also made to the passenger side door).

The biggest bargain in transportation today is a ride on a dial-a-bus. For a lot of reasons.

The buses give door-to-door service. Like a taxi, they pick up anywhere, drop off anywhere. The fare is a fraction of what a cab would cost, from 25 cents a ride up to 75 cents. And you don't have to tip the driver. Waiting time for the bus to reach you is about the same time you would wait for a cab, say from five minutes up to 20 minutes. The buses are new, clean and comfortable. You can usually get a seat, although you might have to stand for part of the trip during peak periods.

In some ways, dial-a-bus beats owning a car. There are no monthly payments to make, no insurance premiums, no parking problems, no expense for maintenance and repairs.

But don't get rid of your car just yet. Dial-a-ride has disadvantages.

The call-a-bus concept doesn't work in all areas. While it's a good way of getting around in small and medium-size towns, the idea has not been successful in communities with populations much over 50,000.

Dial-a-bus isn't likely to replace the privately owned automobile or taxicab even in small communities because the buses do not operate 24 hours a day, seven days a week. They usually run 12 hours a day Monday through Friday, on a 10-hour schedule on Saturday and not at all on Sunday. So if you want to take in a movie at night or if you have to catch a plane Sunday afternoon, you will need some other transportation.

There's another drawback to dial-a-ride. The cheap ride isn't as cheap

as it seems. The money that comes in the fare box isn't enough to keep the buses going. Losses have to be made up by grants, subsidies or taxes. One way or another, the deficits come out of the pockets of taxpayers.

Despite the disadvantages, dial-a-ride is a boomer, zoomer of an idea. It is growing faster than any of the other in-lieu-of-an-automobile forms of transportation. About half the states now have dial-a-ride programs. Michigan alone has 22 cities with dial-a-bus systems. This, ironically, in the home state of the automobile. Even in metro areas, where the idea has been found lacking, a modified form of dial-a-bus is being tested.

Dial-a-ride suffered its biggest failure thus far earlier this year in Santa Clara County (San Jose), Calif. The failure was actually a victory of sorts. The Santa Clara system didn't die for lack of customers. The direct-to-the-door buses had to be abandoned because too many people used the service. The county didn't have the budget, equipment or manpower to handle the number of riders who wanted to use the system. Santa Clara ranges over an area of 200 square miles and has a population of 1,200,000. The buses just couldn't cover that much territory and accommodate all the people who wanted to leave the driving to somebody else.

Santa Clara hasn't given up completely on dial-a-bus. The county is continuing the service on an experimental basis in one area where potential users and routes covered by the buses can be closely controlled.

Santa Clara was regarded as the big test for dial-a-bus in the big

time. Would the idea work in a high-density area? Or is it strictly for low density communities, small towns and rural areas?

The Santa Clara setback unquestionably soured traffic planners in other metro areas on going to dial-a-bus on a broad scale. But there may still be a place for a modified form of dial-a-ride in densely populated urban centers. Instead of offering anywhere-to-anywhere service, dial-a-bus could, and probably will, be used in metropolitan areas as a feeder service for other forms of transportation. That is, where the bus picks up the passenger at his front door and delivers him to a point where he can transfer to another carrier on a fixed route.

If Santa Clara was the classic failure for dial-a-bus in an urban setting, Marshall, Mich., is the classic success in a small-town setting.

Marshall is on a direct line between Detroit and Chicago, 115 miles west of Detroit, 175 miles east of Chicago. Covering six square miles and with a population of 7250, Marshall is a picture-postcard town. Big old houses, trees in front of the business buildings on main street and a radio station that will interrupt a program to alert listeners to be on the lookout for a lost dog.

Marshall has had dial-a-ride since November, 1974. The city operates three mini buses. Two are used on a regular basis, while the third is held on standby to fill in when one of the other units is down for repairs or service. The buses are Dodge vans that have been converted to seat 12 passengers. One bus has a lift for handicapped or disabled passengers.

Marshall's buses operate from 6:00 a.m. to 6:00 p.m. Monday through Friday and from 8:00 in the morning until 6:00 at night on Saturday. There is no service on Sunday.

Fares run from 25 cents to 75 cents. The one-way adult fare within the city limits is 50 cents. Children under 12 and over-65 passengers ride for a quarter. The buses also pick up and deliver a mile or so outside the city limits. The adult fare for riders outside the city limits is 75 cents, 40

cents for under-12s and over-65s. The driver does not make change and riders must have the exact fare.

Passengers are asked to allow 15 minutes for the bus to arrive, but most of the time the bus is there in 5 to 10 minutes. If a passenger wants to use the bus at the same time every day, he can leave a standing order with the dispatcher. He doesn't have to phone in on a daily basis. The buses will pick up passengers who flag them down without phoning if there's room on the bus, but the driver is under no obligation to stop for hand-wavers as on a regular bus line.

I get to Marshall fairly often and I've used the dial-a-bus different days of the week, different times of day. To avoid any red carpet treatment, I did not disclose my connection with *Popular Mechanics* or that it was going to do a story on dial-a-bus until after I sampled the service.

The toughest test I rigged up was to plant two other people at phones in different parts of town while I called from a third location. The bus had to cover a triangle of about 11 miles. The three of us were picked up within 13 minutes. That's pretty speedy service. The bus must have been near one of the pickup points where the calls came in, or the driver violated the speed limit.

The buses are equipped with two-way radios. Phone calls come in to the dispatcher at the Marshall city hall. As a call comes in, the dispatcher writes down the caller's name and the pickup point. She immediately presses the microphone button and reads the information to the bus driver.

Peak-load periods for the Marshall buses are during school hours—when school starts in the morning, during the lunch break and, to a lesser extent, when school lets out in the afternoon. Marshall has a separate fleet of school buses, but due to some quirk in the law, school buses cannot pick up within the city limits. They can only transport students from outlying rural areas.

Parents of young children who used to make two to three round trips a day to the community's several schools now send the youngsters back and forth by dial-a-bus. There are fewer student passengers on the afternoon run than on the morning and noon trips because some children who ride the bus earlier in the day walk home after school.

Some transportation authorities dismiss dial-a-ride as a welfare sop

to what they refer to as "transit dependents"—young people, old people, poor people and those with handicaps that prevent them from driving. Dick Watkins, city clerk-treasurer of Marshall and manager of the dial-a-ride system, refutes this.

Watkins doesn't have a by-age and by-income breakout of all users of the Marshall system, but he denies that dial-a-ride operates primarily for the convenience of senior citizens. In Marshall, over-65s constitute only about 30 percent of those using the service. "We get a good cross section of riders," he adds, "people of all ages, incomes and from all areas of the city." Watkins uses the buses himself.

The Marshall system is not self-supporting and Watkins doubts it ever will be. During good weather, the buses carry about 100 passengers a day. Usage increases during bad weather, but even then the buses handle only 120 to 125 passengers a day.

Watkins has done projections on cost of operation versus income and he says the buses could not pay their way if they carried 300 passengers per day. The buses average about 5000 miles a month and operating costs figure out to about 12 cents a mile.

The only way dial-a-bus can compete against the private passenger car is by holding bus fares down so it's more attractive to ride the bus than to jump in a car. "We have to pay drivers, dispatchers and maintain the equipment," Watkins says, "and it's obvious we don't charge enough to meet our costs."

So where does Marshall get the money to run the buses at a loss? Up to now, funds have come from the state. Michigan wants to encourage the dial-a-bus idea, so it has appropriated financing to get the ball rolling. The state will provide partial funding for the second year of operation. After that, it's up to the local community to come up with the money to keep the buses on the road. That means location taxation. Marshall will put the proposition to taxpayers in the next election.

Dial-a-ride isn't for everybody. Least of all for the guy who has shelled out \$4000 or \$5000 for a new car that has to be fed a steady diet of 70-cents-a-gallon gasoline, not to mention parking meters, insurance premiums and the rest. Why should he pay more taxes to support the share-the-riders who take the bus?

The answer to that could be that if more people don't start riding the bus there might not be enough gasoline available—even buck-a-gallon gasoline—for those who prefer to drive private automobiles. ★★★

A telephone call to the dial-a-ride dispatching office sends a bus to your front door. Here, dispatcher Dana Smith in Marshall, Mich., uses the radio microphone to send bus out to a caller.



Mount your prints to look better and last longer

by Dave Sagarin



Good reasons to mount your photo prints abound: Mounting makes a print thick and keeps it flat, which protects it against curling, cracking and rough handling. But mainly, mounting makes a print special. It shows that you think a lot of the picture, and want others to see it at its best.

Of the many ways to mount prints, the best, in my opinion, is dry mounting, using a press or hand iron to bond the print to a mount board. Dry mounting is permanent, good looking and fairly cheap.

The simplest way to get a print mounted is to have it done commercially. Art supply stores and framers sometimes provide this service; in larger cities, custom photo labs do it, too. A typical price for flush-mounting an 8x10 print on illustration board is \$1.50. But if you have a friend at an ad agency, a corporate graphics department, or an art school, you might be able to use their press, if you don't want to buy your own.

For dry-mounting at home, the first requirement is a clean work space large enough to lay out your supplies, cut mounting

boards, and set prints out to cool. Cover your work surface with cheap board, so you won't feel guilty about cutting into it.

You can't mount a print that's tightly curled. To flatten such prints, dampen them and redry them under pressure. A dry-mount press set at low temperature can speed drying and provide the pressure needed. If you stack prints as you press them flat, you need only dampen one out of three or four.

Cracks, stains, fingerprints and ripples (frilling) can mess up the edge of a print. To avoid these troubles when you're making prints you know you'll mount, center the image on a larger-than-normal-size piece of printing paper, leaving a generous border all around that you'll trim off before mounting.

Basic needs

For dry-mounting you need heat, pressure and dry-mounting tissue. The tissue is impregnated, like wax paper, with meltable adhesive; pressure forces the hot adhesive into the fibers of the mount and print.

During the time it takes for your iron or press to heat, set the print on a piece of mount board and shift it around to decide what size the final mount should be, and where the print should sit on it.

Basic methods

To my mind, there are three approaches to this: *Flush* mounting carries the image to the very edge of the mount, with no border; the print image fights its environment, a good technique for journalistic or other dynamic shots. *Centered* mounting is more formal, with a border (often a raised "mat") surrounding the image; usually both sides and the top are the same width, and the bottom is a bit wider, but some pictures (shots of rooms with low ceilings, for example) seem to look cramped if you don't widen the top border. *Centered-flush* mounting runs the printing paper to the edge of the mount, but leaves the image centered; to keep the borders white, you'll need a cropping easel, unless you're printing the whole negative. Many photographers widen their enlargers' negative carriers with a file so that light shining through the clear film borders around the image area will leave a black outline to "frame" the image on the paper (as shown in the top photo on this page).

Once you've decided how you'll mount your print, you can rough-trim it to within an inch of the area to be mounted. The mounting board should be cut to the same size as the rough-trimmed print for flush or cen-

tered-flush mounting; for centered mounting, leave generous borders. If you're going to frame or mat the print, make sure the mount board size is measured in whole inches to allow the use of precut frames and to simplify cutting the overmat.

Measuring and cutting

To measure, use a rigid ruler and start at the one-inch mark, remembering to subtract one inch from the result (first and last inches on a ruler may not be cut accurately). Use a hard, sharp pencil, and mark measurements with tiny dots.

For cutting, lay a heavy metal straightedge (other materials can be cut into) across the mount or print so the measurement dots just peep out from under its edge; a wide strip of masking tape stuck to the bottom of the straightedge will help keep it from slipping. Arrange the work so that you're in a comfortable position, with bright, nonglaring light placed so neither the straightedge nor your hand will cast a shadow on the cut, and so that the blade will cut into waste area if it slips.

The best way to cut prints is with a single-edged razor blade, held with its surface perpendicular to the print and its edge entering the cut at about a 30° angle. Cut with a smooth, light touch; double-weight prints will probably take two or three strokes.

To cut mount board, use a mat knife or a razor blade in a holder. Change blades frequently—dull blades tear as they cut and require more cutting pressure with an increased chance of slipping.

By now, your press or iron should be hot. Put print and board in the press about a minute to dry them out and reduce curl. Open the press at least once to let dry air in.

Cut a piece of dry-mount tissue the same size as the rough-trimmed print. Set the print face down and make sure it's completely clean and dust free—if you don't, you'll see how large a bump a tiny piece of grit can make. Put the tissue on back of the print and tack it down with a short stroke of the iron from the center of the print toward one corner, to keep it from shifting. Don't press hard, or you may leave a ridge in the print. A tacking iron (drawn toward you, not to its point) made for this is best, but you can also use a corner of a mounting press or the tip of a clothes iron. You can get tacking irons, mounting tissue and mounting boards at art supply or photo shops.

Use the right heat

Your iron should be just hot enough to tack the tissue, not hot enough to melt the tissue over the

iron. Practice on waste stock, first, waiting a few minutes after each heat-setting change to let the new temperature stabilize.

Now that they're tacked together, trim print and tissue to the exact edge of the image you want to see. Position the trimmed print on the board by eye, moving it until you like the way it looks. Then check with the ruler that the side borders are equal and the print is square to the board edge. Gently lift the untacked corner of the print, and slide the iron underneath to tack the tissue to the board: If you have a mounting press, protect the face of the print with a sheet of clean, smooth, porous paper, such as 100-percent rag drawing paper, and insert the covered print into a sandwich of mounting boards or hardboard till the sandwich is thick enough for the press to apply maximum pressure.

To set press temperature properly, start with a medium heat, insert a single-weight, nonresin-coated scrap print tacked to a two-ply mount board, close the press without locking it, count five seconds, then remove. The print should lie flat, with its



Mounting tricks include centered-flush mounting (top; note black border around full-negative image); matting (above, center); use of "tacking iron" (bottom) to hold tissue in place while mounting.



Typical presses are Technal 500 (top), \$150; Seal Junior 70 (left), \$117. Larger sizes cost still more. Technal Rollermount (above) is basically a heavy, heated roller, costs just \$50.

edges lifted, and should peel off when the board is flexed. If it doesn't lift off, the press is too hot; if it doesn't even flatten out, it's too cold. Once you find the right temperature setting, a permanent mounting should take about 15 to 20 seconds with the press locked shut. Thicker, glossier and larger things require higher mount temperatures and longer times; RC prints and special tissues recommended for them, require lower temperatures and shorter times. (In testing with RC-type tissues, note that if the print peels off when the board is flexed, the press may be too hot.)

You can use a clothes iron

If you're using a clothes iron, use it dry (no steam), set it to "synthetic" and use the low-temperature RC-type tissues. Preheat the print and mount individually by covering them and slowly ironing all over. Trim and tack as above. To mount, iron one swath at a time, heating first by ironing gently from the center toward one edge for several

passes before pressing firmly. Keep the iron moving, and don't let the cover sheet shift. Check each swath as it is completed. Work toward each edge, then toward the corners. When mounting is finished, the print should lie perfectly flat.

When print comes from press

Ridges and bubbles in the mounted print may be eliminated by reinserting in the press or reironing, first with gentle pressure to heat the affected area thoroughly, then with very high pressure to flatten it down (use extra boards in your press sandwich for increased pressure).

The tissue is soft when the print comes out of the press; to reduce edge-lifting, cool it under the pressure of piles of books, or other weights, with newspapers protecting the print.

Choosing your mount board

Mount boards come in several types from art supply stores and large stationers in a variety of sizes, finishes, colors and substances.

Illustration board, a quality paper surface on a pulp core, is the choice for most work. Thicker, four-ply board is better than two-ply for large mounts or when the print will get a lot of handling. Museum board is a premium type whose composition varies: The best is 100-percent natural cotton fiber throughout ("100-percent rag" is not the same—it's mostly synthetic fiber these days), but there are also cotton-faced pulp-core boards, and boards faced with acid-free sulphite. Your board and pictures will last longest with 100-percent cotton board, but it costs about four times as much as illustration board.

You can also use a piece of photographic printing paper, fixed and washed and mounted back-to-back with your print; it will age well and be light without warping.

Matting

For wall-hung prints, try a mat—a piece of cheap board with an expensive hole cut in it that the picture peeps through. The mat's color and texture act as moderators between the image and the wall—you're freer to experiment with colors, here, as you can always throw the mat away if you don't like it.

Cutting a mat takes skill and special tools—you may prefer to have it done by a professional framer. If you do it yourself, be sure to measure precisely: First measure the image area and the exact distance from each edge of the image to the nearest edge of the mount. Sketch these on paper. Now cut the mat board to the exact size of the mount, lay it face down, and mark hole dimensions on the back by transferring dimensions of the sketch, top to top, bottom to bottom, but reversing the sides.

This latter step shouldn't be necessary if the print was exactly centered on the mount, but somehow, it always is. After cutting the mat, if its surface is dark in color, darken the newly cut edges with a felt pen.

The print is now ready to be framed, but if you're going to hang it with clear plastic framing or edge clips, finish the job by binding the mat and mount together with Mystik tape.

What sizes and materials to use for your mounts are matters of taste. Be willing to experiment, and to throw out any results you don't like. Take every opportunity, too, to look at exhibits of photographs, lithographs, drawings and etchings to see how they are mounted. Those artists faced the same problems—and they're probably still not sure they did the right thing, either. ★★

How to take the jolt out of buying shocks

by Mort Schultz

Shock absorbers keep a car from bouncing. Springs or torsion bars do the same, but springs or torsion bars without shock absorbers aren't enough.

Springs or torsion bars compress and rebound with every up and down movement of the wheels. On a glass-smooth highway, they alone would give you a pretty comfortable ride.

But what road is glass-smooth? If they don't have potholes, they have cracks, and if they don't have cracks, they have dips. That's why a car needs shocks—to dampen sudden up and down motion which springs or torsion bars can't handle. This prevents bounce and body sway.

Every wheel in practically every car has its own suspension system, consisting of one spring (or torsion bar) and one shock absorber. Springs are usually of the coil variety up front, and leaf type in the rear.

A torsion bar comprises two rods of spring steel. One end of the bar is fixed solidly to part of the frame behind the wheel; the other is attached to the lower control arm. As the wheel hits a bump, the lower control arm rises, and the torsion bar twists,



Air line that is attached to air shocks should be routed away from hot spots.

taking the brunt of the shock. It untwists when pressure is relieved.

The danger of bad shocks

Since the job of shock absorbers is to dampen the effects of sudden impact, it stands to reason that when shocks fail a car will ride harsher, it might bottom, and you may get a clunking or rattling noise from below. But there's another aspect to shock absorber failure that is being investigated: Do faulty shock absorbers account for the rising number of single-car crashes each year? In these accidents a car leaves the road for some unknown reason and smashes into a fixed object. Bad shocks may be the cause of some of them.

The job of shock absorbers is to assure that all four wheels remain on the road, even on the worst surfaces. But suppose shocks are bad and a driver is forced to make a panic stop? Experiments have shown that when shock absorbers are worn, a car's front wheels can lose contact with the pavement during hard braking, which obviously can cause a loss of steering control.

Testing your shocks

What can you do to protect yourself against this possible danger and

to see to it that riding comfort is not destroyed by faulty parts?

You can test the condition of your car's shock absorbers periodically. I mean every 5000 to 10,000 miles although manuals say the average life of shocks is 20,000 miles.

Maybe it is and maybe it isn't. I have seen cars driven mainly on rough roads wear out shock absorbers in 5000 miles. Conversely, I have driven cars primarily under ideal highway conditions and had their shocks last past 40,000 miles.

Testing is easy enough, so why fool around? At one corner of the car, press down on the bumper or fender as hard as you can. Keep pressing and raising the corner until the body is rocking. Then let go on a downstroke. The body should bounce upward once and settle level. If it bounces more than once, a weak shock absorber may be in that corner. Perform the bounce test at each of the other corners.

Another revealing test is to "test drive" shocks. Drive your car on a smooth pavement at 10 mph. Tap the brake pedal repeatedly. If the car rocks—that is, if the front end dips and the rear end rises excessively—



Upper shock mounting is reached with a socket and extension; open end holds nut.



Air valve fitting for air shocks is often mounted in the trunk of the car.



Rubber chamber identifies this rear shock absorber as being the air type.

the shock absorbers may be at fault.

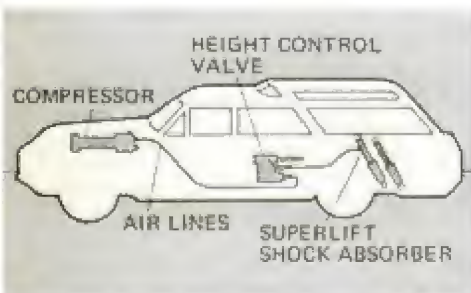
At this point, you have some decisions to make. First should you do your own shock-absorber service work?

By doing it yourself, you'll save considerable money. In addition, you will have the chance to make final, more affirmative tests that will establish whether a shock absorber is really in bad shape. A professional mechanic who removes an old shock isn't about to reinstall it even if he finds it adequate. He makes more money putting in a new one.

What price shocks?

How much are shocks going to cost you if you do the work yourself? How much if you have a mechanic do it for you? Here's what I found out about shock absorbers for a late-model station wagon. I specified heavy-duties—that is, a top-quality shock for the car.

I first went to a dealer. He wanted \$14 for each shock (\$56 for four) and \$19 to install them. Total: \$75. He told me he could not guarantee the shocks for as long as I owned the car—only for 30,000 miles. This is important.

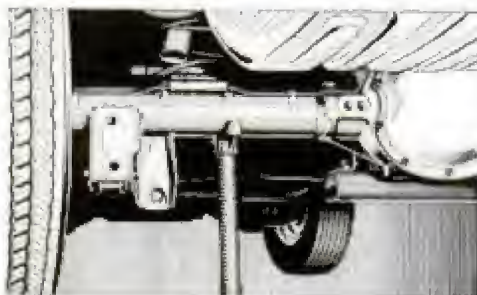


Automatic load leveler system is shown here with the main components indicated.

I then called the auto department of a leading national chain store. For the best heavy-duty shock absorber for this wagon, the price was \$8.49, or \$33.96 for four. I was also told that I would be charged \$4 per shock (\$16) if I wanted them installed.

Let's break it down: Buying shock absorbers from the chain store and doing the installation myself would save \$41.04. Even if I told the store to do the job for me, my saving would still be \$25.04. But here's the kicker: the shocks from the reputable chain store were guaranteed for as long as I owned the car. If a shock went bad (and no shock absorber, even one with a "lifetime" guarantee, lasts forever), the store would replace it at no cost to me.

I suggest that before you decide how to approach shock-absorber replacement that you phone for price information. Call a dealer, service



Support rear axle with a jack stand when you remove the rear shock absorbers.

station, independent garage, auto-parts house and chain store.

Standard and heavy duty

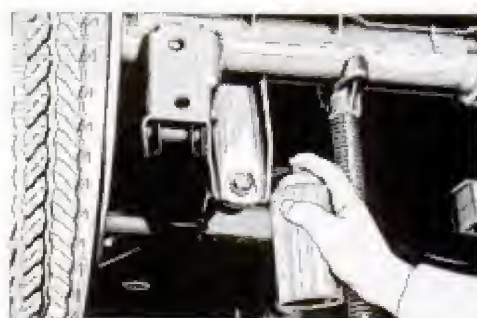
To this point, we have discussed standard hydraulic shock absorbers. There are two general kinds of hydraulic shocks: standard and heavy-duty.

Standard shocks are for standard driving—that means little-old-lady driving on smooth streets. And as long as you don't haul heavy loads too often, standard shocks will serve okay. But they cost only slightly less than heavy-duty shocks, and you don't get the same guarantee.

Heavy-duty shock absorbers are for more vigorous driving and suited for heavy cars and station wagons and/or when a heavy load is imposed on the vehicle frequently. They are more expensive, but carry a better guarantee—"lifetime" by some manufacturers and distributors.

Air shocks

A third type is the air shock (for rear use only)—ideal for hauling trailers or other heavy loads. Air shocks mount in the normal manner, but an air line feeds off each to a



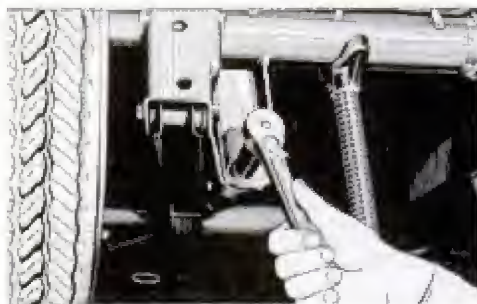
Penetrating oil is necessary when you replace shocks. Apply and let it soak in.

common tee where they come together with a single line that branches to an air-valve fitting installed in an easy-to-reach spot, such as through a rear panel or through the trunk.

One important point if you decide to spend the \$50 or so for a pair of air shocks (the quote was from the national chain store I mentioned earlier): Keep those air lines away from hot spots, such as the exhaust. Otherwise, since most lines are plastic, you will soon have air shocks that can't be fed because of burned-out lines.

A few more points about air shocks: you can vary air as needed to support the weight of the load you're hauling—from a car full of passengers and luggage to a 32-foot trailer, but most air shocks should not be filled with more than 90 pounds per square inch of air (check manufacturer's requirements). You could blow the diaphragms if you add more than the manufacturer advises.

When you don't need the support, you can, of course, bleed off the air—just as you would bleed a tire. But most makers recommend a minimum of 20 p.s.i. As with tire valves, keep



Lower shock mounting is easy to reach, but the nut and bolt are often frozen.

Rear shocks

When you do the job, jack the car and use jack stands under the rear axle (as near the shocks as possible). With the rear axle supported on both sides (to take strain off the shocks and make removal easier), give upper and lower mountings a good shot of penetrating oil. Give it time to do its work. With a proper fitting socket, remove the lower mounting. Let the shock hang loose. Now is the time to find out if it really needs to be replaced.

Push on the unit and extend it a few times. Now, push in on it again. You should encounter resistance, with maybe a bit of a lag during the final $\frac{3}{8}$ inch of movement, which is normal. If your shock resists you in good manner, rebolt it. No sense replacing a good one.

If you want to get an idea of what a good shock absorber feels like, go to a local service station or auto-supply store. They usually have a display set up—good and worn shocks side by side.

There is always one way to be sure if a shock absorber is bad: you'll see it leaking oil. But be discriminating: Oil should actually be dripping for you to conclude that the shock is shot. An oily film on a shock absorber's body doesn't necessarily mean the part is faulty.

Some service managers argue that you should replace one bad shock at a time. Others contend that shocks should be replaced in pairs on the same axle, even though one isn't bad. They say you *may* experience fore-aft sway.

But why throw away a good shock and buy a new one if you don't have to? Replace the bad shock. Road test the car. If it doesn't handle the way it should—if you do get fore-aft sway—you can always replace the other one.

Removing rear shocks from their top fasteners usually poses no problem, except maybe for a frozen bolt.

the air valve covered with a cap to keep dirt from entering the system.

Automatic load levelers

Are you familiar with the luxury air-shock system—the automatic load leveler system? This consists of an air compressor that feeds the two rear airlock shifts through a height control valve which senses need. As a load is imposed, the compressor which runs off engine vacuum automatically puts out air to an air-pressure regulator valve. The valve assures that shocks are never filled with enough air to damage them.

The height-control valve opens and closes according to weight to allow more air to enter the shocks when it's needed, and to let shocks bleed themselves when air isn't needed.

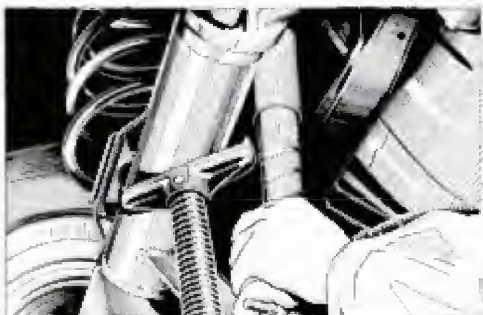
If you have automatic load levelers, a very easy way to check the condition of the system is to have a couple of friends sit on the trunk, but first make sure there's at least 100 p.s.i. in the reservoir pressure tank.

Wait a few seconds. You should see the rear start to rise. When your friends get off, the rear should rise a bit, and then settle back down after a few seconds.

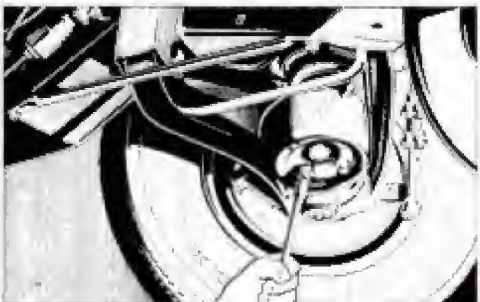
By the way, you can probably equip your car with an automatic load-leveler system if you have about \$300 to spend.

Doing the job

Getting back to the standard hydraulic shocks, here's what you should know about replacing them. The procedure may vary somewhat from car to car. You have to remove bottom and top mountings, but there are a few precautions and angles to watch out for.



Rear shock absorber can be tested after the lower mounting is disconnected.



Front shocks are usually located in coil spring. Here, lower mounting is loosened.

Front shocks

Working on most front shock absorbers requires more effort than in

the rear. That's because on most cars the shock is encased in a coil spring. To test the shock and make sure it's really bad requires that the part be removed and taken to a workbench.

Raise the front. You do not need jack stands for the suspension; only to properly support the car.

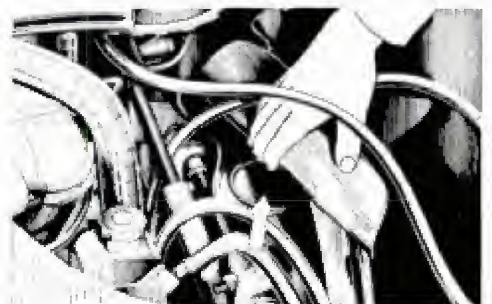
One problem you may encounter is clearing the ground with the shock absorber once it has been disconnected, assuming the part is removed from below and not through the engine compartment.

Disconnect the lower fasteners first. Now, as much as possible, compress the shock to allow for ground clearance. From up top—usually through the engine compartment—unfasten the shock's top mounting. Now remove the part, compressing it more and more until it clears the ground if the wheels haven't been raised.

At your workbench, extend the shock fully, making sure it is right side up. Turn it upside down and slowly collapse the unit. Do this at least three times to purge air from the unit.

On the final push, judge resistance, keeping in mind that the last $\frac{3}{8}$ inch or so may demonstrate some free play, which is normal. If the shock absorber proves to be bad, just throw it away. You can't repair a worn one.

One final point: New shock absorbers are not always the answer to handling. If your car has sagging or broken springs, out-of-balance wheels, worn ball joints, tie-rod ends or steering gear, bad tires or defective front-wheel bearings, you'll only be wasting your money on new shocks. ★ ★ ★



Upper mounts of front shocks are often reached from inside engine compartment.

What's new in TV equipment for this fall is mostly a matter of minor but intriguing devices. It's a comedown from the recent, more dramatic race for brighter picture tubes (page 85, May '74) and the switch from tubes to solid-state components. But for the manufacturers, many of whom have been in the red recently, it's a chance to take a breather and to concentrate on profits: Prices are \$10 to \$40 higher than last year, and most warranties are down from one full year to 90 days.

Zenith's latest (top right) is a circuit that lets you zoom in on the center of the picture until it fills the whole screen—all by remote control. For even larger images, there's now a widening variety of sets that project TV pictures as big as home movie screens: Sony's folding, \$2500 unit (left) and one from Muntz (\$1600), both new, have now joined the Advent (now \$3695) and professional



Sony's latest projection TV. Its first designed for home use, combines tuning and control circuits, projector and 40-inch screen into one \$2500 cabinet (top) that folds when not in use (bottom photo above).



Got a problem corner? This 25-inch Zenith panorama console is designed to fill it neatly, for \$790.



Zoom in for a closer look at the action: Several new Zenith sets (top) enlarge the center of the picture 50 percent when you press a button on their remote controls, as shown above.

New in TV for '76

by Jim Lockett

Sony units on the market.

Sony also has a new video tape system designed for home use. Its new Betamax video recorder (right) with built-in 19-inch TV produced color pictures of near broadcast quality in the demonstration I saw, even though it's about the most miserly user of tape that ever reproduced a moving color picture. It uses less than 21 square feet of tape an hour (about the same as stereo tape at 7½ inches per second), versus about 70 square feet or more for most other nonbroadcast VTRs.

On the smaller side are RCA's new portables (below, right), with built-in bat-

Sony Betamax video tape recorder is the only videoplayer/recorder sold in the U.S. specifically for home use. With 19-inch color set as shown, it's \$2300. Separate tuner lets you watch one show as you tape another to view later.



Color portable from Panasonic has 4½-inch screen, switches automatically from a.c. power to self-contained rechargeable batteries, also works off car or boat battery. It's \$480.



teries that can run about four hours per charge and are claimed to be good for an impressive 170 recharges; the batteries are a new, lead-acid type from Gates Rubber. Panasonic's latest portable is an even smaller set, this one in color with 4½-inch screen and built-in batteries.

Games that use TV screens as playing fields have come full circle: Magnavox's Odyssey, which started it all, was followed by more versatile, coin-operated TV games in bars, bus stations and amusement arcades. Now Odyssey has been redesigned to have sound effects and on-screen score-keeping, just like the quarter-a-play models downtown.

The trend to all-electronic varactor tuners (page 134, Dec. '73) continues: Pushbutton varactor tuners are all over the place (in Zenith's line, they even outnumber the electromechanical ones) and touch-button varactor tuners, though less common, are catching on. Also rising in popularity are rotary tuners covering both UHF and VHF with a single knob.

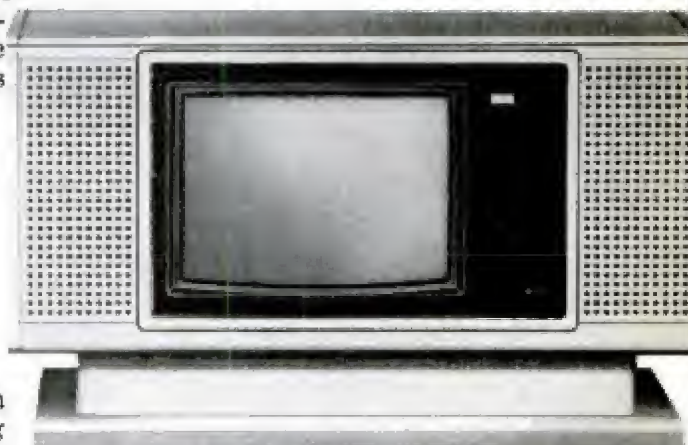
These tuners combine 12 conventional VHF tuning strips with several individual-channel tuning potentiometers for UHF in a single, turret channel selector.

But the most advanced tuner around is the Magnavox Star system, with a calculator-like remote keyboard on which you simply punch in any channel number from 2 to 83. The channel change is silent and almost instantaneous, and the channel number is displayed on the screen.

This year, almost everybody has in-line-gun picture tubes, which reduce convergence problems and manufacturing costs. Zenith's new 13-inch in-line tube also has a 110° deflection angle (versus 90° for most competitors), which cuts its length almost two inches. Quasar now has the Quintrex tube, with an extra prefocus "lens" for sharpness, shown last year by Panasonic.

But if you shopped for color TV last year and didn't buy, you may kick yourself when you see this year's prices and warranties. Quasar, Hitachi, Sharp, Toshiba, Sears and a few others still have long warranties. And if you hurry, you may still find some leftover '75 sets. ★ ★ ★

Biggest Trinitron-tubed set yet is this new 25-inch Sony. It's available only in Japan, so far. Price of console version is about \$2000.



Compact "console" is actually a GE 19-inch color portable with an optional, matching console base. Set is \$470, base \$55.

Truly portable, these RCA sets have built-in batteries that run for about 4 hours on each charge, are good for about 170 recharges. Price is about \$160.



No one in his right mind is going to tell you that painting a house isn't a big job. But because it's a big job, it means big savings when you do it yourself. The cost of materials is only one-fifth to one-fourth the cost of a professional paint job, so doing your own painting means saving 75 to 80 percent of the cost of having it done. If you approach the job in an orderly way, it can be relatively easy and even pleasant.

If you can't work on high ladders or just don't want to, you can still save money—many painting contractors are willing to do the upper portions of a house and leave the more accessible areas to the owner.

Don't feel guilty if you're reluctant to begin the job right away—it may not be needed. Too-frequent painting just builds up a coating of paint that's thicker than necessary, and wastes time, money and effort in the process. Washing may be all it takes to restore a bright appearance. A house is ready for repainting when the old coat of paint has weathered enough that wood grain is becoming visible through it. Inspect your house's paint job at least once a year and you won't be repainting too soon or too late.

What to use

A house isn't a simple object like a box. It's a system, with different components that have different functions: they're made of different materials and require different treatments for maximum protection and best appearance. The chart on the opposite page is a comprehensive guide to the right primer and finish-coat materials for the outside of your house-system. In every case, you should use the best quality paints you can afford. The difference in cost will be small compared to the extra cost and effort that will result from an inferior job that doesn't last. Well-known brand names are your best assurance of quality, and it's a good idea to read can labels carefully before you buy.

Priming is essential on new and bare materials—exposed wood edges, especially plywood edges, require extra attention here—but is usually not needed when covering an existing top coat that is weathered but otherwise in good condition. New gutters and leaders may have a protective oily film; it must be removed before priming.

Either latex or oil-based paint can be applied over existing paint or a compatible primer. Latex paints have gained favor because they're easier to apply, dry faster and retain color

House painting: The right way is the easiest way!

by Stephen Walton

ASSISTANT EDITOR, HOME AND SHOP



Photos: Stephen Fay



Selecting primers and top coats

The charts below show primers and top coats appropriate for exterior surfaces. Find primer or choice of primers for the surface, then the top coat—or work backward from desired top coat to find the primer and make sure that coatings are right for the surface.

	SURFACES													
	SMOOTH WOOD SIDING	ROUGH-SAWN SIDING	SHINGLES AND SHAKES	PLYWOOD	WOOD TRIM	CONCRETE, BLOCK, STUCCO	BRICK, STONE, CINDER BLOCK	IRON AND STEEL	GALVANIZED STEEL	ALUMINUM	ALUMINUM SIDING	COPPER, BRASS, BRONZE	ASPHALT ROOFING	SHINGLE AND SHAKE ROOFING
OUTSIDE PRIMERS														
OIL PRIMER (1)	•	•	•											
ALKYD PRIMER (2)					•									
LATEX PRIMER (3)	•	•	•	•										
STAIN BLOCKING PRIMER (4)	•	•	•	•	•									
ALKYD BASE METAL PRIMER (5)						•	•	•	•	•				•
OIL-BASE METAL PRIMER (6)						•	•	•	•	•				•
LATEX METAL PRIMER (7)						•	•			•				•
PORTLAND CEMENT PAINT (8) (FOR METAL)						•	•							
MASONRY SURFACE CONDITIONER (9)					•	•								
PORTLAND CEMENT PAINT (FOR MASONRY) (10)					•	•								
ALKALI RESISTANT COATINGS (11)					•	•								
IRON OXIDE PRIMER (12)														•
NO PRIMER NECESSARY (13)												•		
TOPCOAT MATERIAL USED FOR PRIMER (14)					•	•								
OUTSIDE TOPCOATS														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
OIL-BASE GLOSS HOUSE PAINT	•			•		•			•			•		
OIL-BASE FLAT, EGGSHELL HOUSE PAINT	•			•		•			•			•		
BARN PAINT	•			•		•			•			•		
ALKYD HOUSE PAINT		•		•	•				•			•		
ALKYD TRIM ENAMEL		•		•	•				•			•		
LATEX FLAT HOUSE PAINT			•	•			•		•			•		
LATEX TRIM ENAMEL			•	•			•		•			•		
CLEAR FINISHES													•	•
SEMITRANSSPARENT STAIN													•	
SOLID COLOR STAIN													•	
ALKYD BASE MASONRY PAINT									•				•	
LATEX MASONRY PAINT									•				•	
ALKALI RESISTANT COATINGS									•		•			
PORTLAND CEMENT PAINT (FOR MASONRY)										•				
SILICONE WATER REPELLENT COATING													•	
OIL-BASE EXTERIOR METAL PAINT						•						•		
ALKYD-BASE EXTERIOR METAL ENAMEL					•							•		
ALUMINUM PAINT					•									
PORTLAND CEMENT PAINT (FOR METAL)								•						
BITUMINOUS ROOF COATING													•	
COLOR-ED ALUMINUM ROOF COATING													•	
LATEX PAINT (FOR ROOF COATING)													•	

Courtesy National Paint and Coatings Assn.

Estimating paint quantity

Determine the area to be painted in square feet; don't forget to include soffits; deduct for openings. Most house paints cover 450 to 500 sq. ft. per gallon on smooth surfaces—check the label on paint you will use. **Add to estimate:** 20 percent more paint for porous or rough surfaces, 10 percent for narrow siding, 33 percent for corrugated metal, 100 percent for a first coat on concrete block.



Load brush by dipping into can so that bristles are filled halfway up. Tap brush against can side to remove excess paint.



Paint butt edges of beveled siding or shingles first, doing a 3 or 4-ft. run, so paint on wide part will be unmarred.

better. They also resist blistering and peeling better; but blistering and peeling are usually caused by moisture problems (see page 122). For the do-it-yourselfer, the fact that equipment used with latex paints can be cleaned up with soap and water is a considerable advantage.

Getting surfaces ready

Proper surface preparation for painting is work—plenty of work.

But it's your insurance against getting the kind of result that makes you wish you'd left the whole thing to a pro, and against later paint failure. Prepare surfaces thoroughly and you won't have unpleasant surprises in the future.

If there's any evidence of a moisture condition, correcting the condition is your first step (see page 122 for a more complete discussion).

The next thing to do is tie back

plantings and cover them with drop-cloths. Do it now, because flakes of old paint and mildew-killing washes are just as harmful to plants as paint.

Then let the checklist on this page guide you. It's unlikely that everything included will be necessary on the exterior of your house, but know what to look for.

When you've had to take an area down to bare wood, feather it into

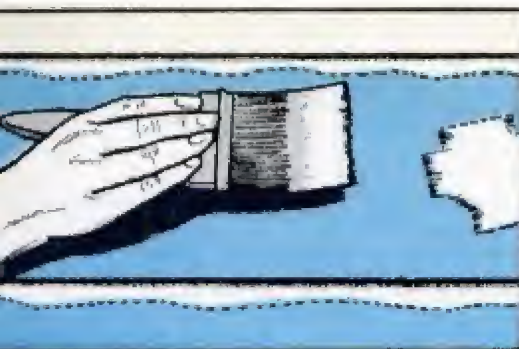
Preparing surfaces

Use this checklist:

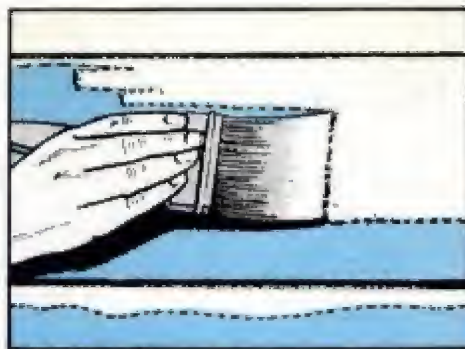
- ☐ **Sound existing paint:** Remove loose dirt with dusting brush, smooth rough areas with sandpaper.
- ☐ **Checked, alligatored, blistered, wrinkled or peeling paint:** Scrape, wire-brush and sand down to bare wood. Chemical paint remover may be required for large areas; do not use a blowtorch.
- ☐ **Mildew** (looks like gray dirt): Scrub with solution of household bleach, laundry detergent and trisodium phosphate (wear rubber gloves and eye protection); rinse; use primer and paint containing mildewcide.
- ☐ **Excess chalking:** Remove with a wire brush.
- ☐ **Loose, rotted or damaged boards:** Replace badly damaged or rotted boards; re nail loose boards that are sound, set and fill nailheads. Small cracks can be filled with wood putty.
- ☐ **Glossy areas of existing paint:** Sand to provide "tooth" for new paint to adhere to or apply deglossing surface conditioner.
- ☐ **Openings and joints:** Fill with caulking compound.
- ☐ **Old caulking, window putty:** Replace if dry or brittle.
- ☐ **Nailhead staining:** Sand area to bare wood, bare metal of nail; set nailhead, prime before filling hole.
- ☐ **Bleeding** (stains caused by seeping of colored matter in wood): Use stain-blocking primer.
- ☐ **Masonry:** Remove dirt and loose material with wire brush.
- ☐ **Gutters and leaders:** Remove all rust and corrosion with wire brush and sandpaper; patch any holes.

Choice among variety of applicators is determined by type of job, paint





Apply paint in heavy dabs to weather face of siding, then begin smoothing the dabs out with long leveling strokes.



Finish spreading paint evenly across section of siding to produce uniform coat free of brush-stroke marks.

the surrounding painted area by sanding by hand, not with a block or power tools. This will make the existing paint coat taper off into the bare area and keep the spot from being visible through the new coat.

After all other necessary steps have been taken, dust the surfaces off, wash with warm water and mild detergent, rinse with a garden hose and let dry.

Choosing applicators

Split ends, called flags, are as welcome on brush bristles as they are unwelcome in a woman's hair. They help the brush hold paint and spread it evenly, and the more of them you find on a brush the better. Brushes are made with either natural bristle (usually hog bristle) or artificial bristles of nylon or polyester. A synthetic-bristle brush should be used with latex paint.

A good brush will feel springy when you push it against the back of your hand. Draw the brush over a hard surface; its bristles should not fan out too much. Separate the layers of bristles and look for a strip (a gap) between them at the heel of the brush; it's one sign of a quality brush with good paint capacity. A good brush will not show gaps between the bristles at the tip when you hold it up to the light; one that does will hold less paint and apply it streakily, especially with latex paint.

The size of a brush is as important as the quality of its manufacture. On siding, use the widest brush you're comfortable working with, so long as it's no wider than the boards. Narrower brushes are essential for trim; too wide a brush will produce sloppy results and be damaged in the bargain.

Selection of a roller cover depends on the paint you're using and the surface you're covering. Use a short-nap cover for smooth surfaces, a long-nap cover for rough surfaces and a medium-nap cover for moderately rough surfaces. Latex paints

require synthetic-nap covers; with other paints you can use either synthetic or mohair in short nap and either synthetic or lamb's wool in medium nap. A quality roller cover has a strong core and does not mat; it will get maximum hiding power from the paint.

Pad applicators, also known as shake painters, can be used with oil-based or latex paints or stains, and are sold in a variety of sizes. They work faster than brushes and produce as smooth a coat.

Spray painting is an available option. You can buy or rent the equipment, including light "airless" spray guns that require no external compressor and handle latex paints. Spraying requires careful masking of areas paint is not to reach, as well as protection for the operator. And on a windy day spraying is out of the question.

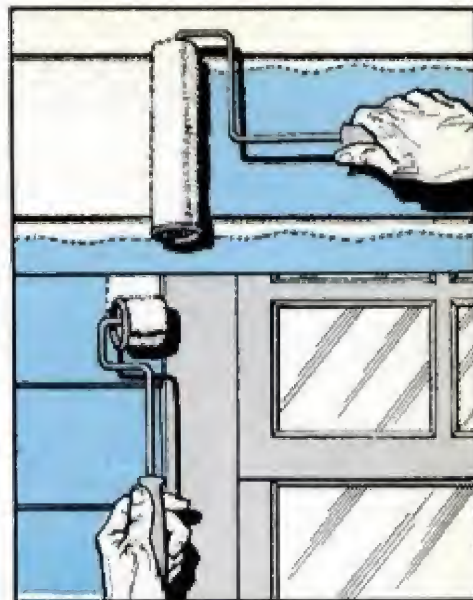
Putting it on

Watch the weather. Most house paints should not be applied if the temperature is below 50° F. (60° for some) or above 95° F.; check the label for precise recommendations. If it's raining or likely to rain, don't paint.

Latex paints can be applied to damp—but not wet—surfaces. Oil-based paints cannot. Excess morning dew should be wiped away. (But when working with some latexes on extremely hot, dry days you're advised to wet the surface down—here again, check the label.) The old rule, and it still applies, is to follow the sun around the house, never painting in direct sunlight but doing each side after it has been in the sun.

All windows and trim should be painted before you begin the siding. This way you won't be resting ladders against freshly painted surfaces, or running the risk of a ladder slipping on wet paint. Work from the top down on siding, so drips will fall on old paint and be easy to remove. Work in sections measuring about 3

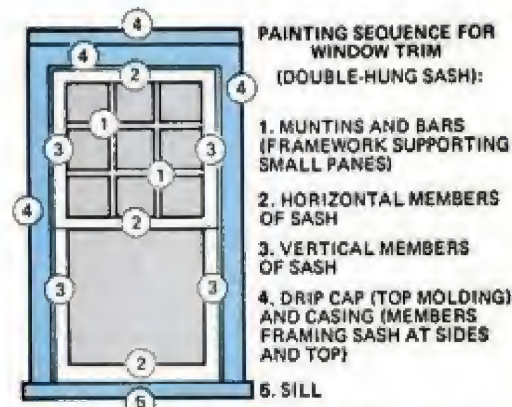
(Please turn to page 122)



Roller can be used with latex house paints. Use brush on butt edges first, then roll into area already painted. Edge roller handles areas next to trim.



Pad applicator, like roller, requires tray, is used with back-and-forth motion. Pads are replaceable, can be used with both oil-based and latex paints.



Use masking tape or shield to keep paint off glass—and remove tape before paint dries. Begin painting with inside (lower) sash raised, outside (upper) lowered.



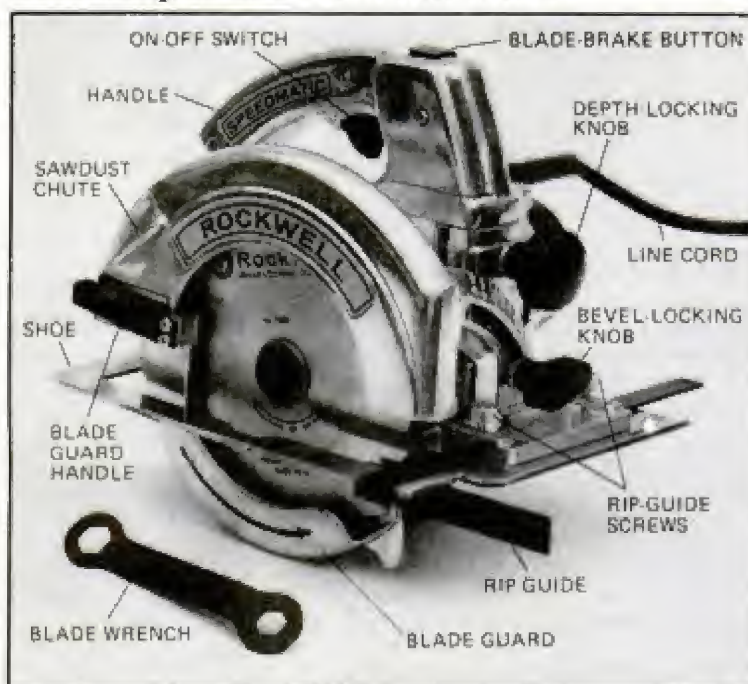
Penetrating stains, semitransparent or solid-color, are easily applied to shingles or shakes with brush or pad. Excess that does not penetrate is wiped off.

Portable saw know-how

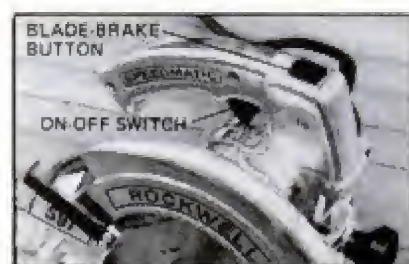
A circular saw lets you come close to duplicating what you can do on a bench or radial saw.

by Harry Wicks WORKSHOP EDITOR

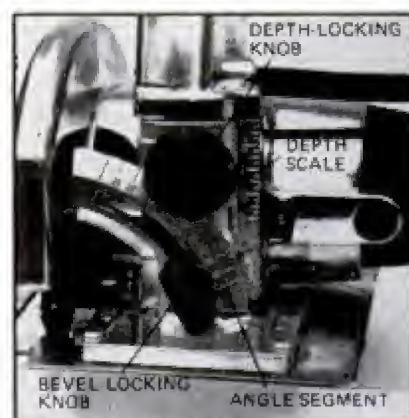
Picture guide to circular saws



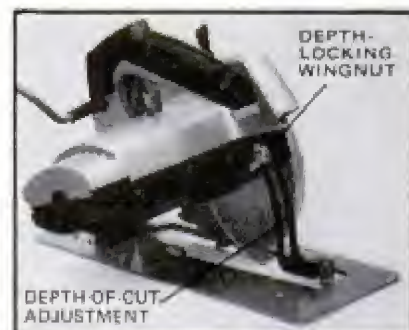
Typical circular saw includes rip guide and blade wrench. Various makers use different methods for setting and locking blade at desired depth. See photos at far right.



Good safety feature on a Rockwell saw—a thumb-operated blade brake.



To adjust cutting depth, raise or lower saw body, lock it in place.



Other method is to change depth by pivoting, as this Skil saw does.

It doesn't take very long for anyone interested in do-it-yourself jobs to realize that a portable circular saw is a "must-have" tool. With a power saw, you will be able to do your cutting a lot faster with considerably less effort than ever before. What is often surprising to a first-time saw owner is just how much a circular saw—used properly—will upgrade craftsmanship.

Be aware there is a certain hazard involved when cutting with a portable saw. By recognizing this and using the tool as it is supposed to be used, the chance of accident is drastically reduced. As with most tools—hand and power—common sense plays a very important role when it comes to safety. Once you understand the tool and how to handle it correctly, you will wonder how you ever got along without it.

Circular-saw basics

As you view a circular saw from its right side, the spinning blade rotates in a counterclockwise direction. This means that the blade does its

cutting on the "upstroke." For this reason, whenever it makes a difference (with the material being worked) the cutting is always done with the "good," or "decorative," side down.

Circular saws are generally described by size: for example, 7-inch, 7¼-in. and the like. This size denotes the maximum-diameter blade that the saw will accommodate. Thus, a 7¼-in. saw will accept blades of a diameter up to and including 7¼ in. This particular size is generally considered most desirable by do-it-yourselfers. Larger-diameter, more expensive saws are available, but these are intended primarily for building tradesmen.

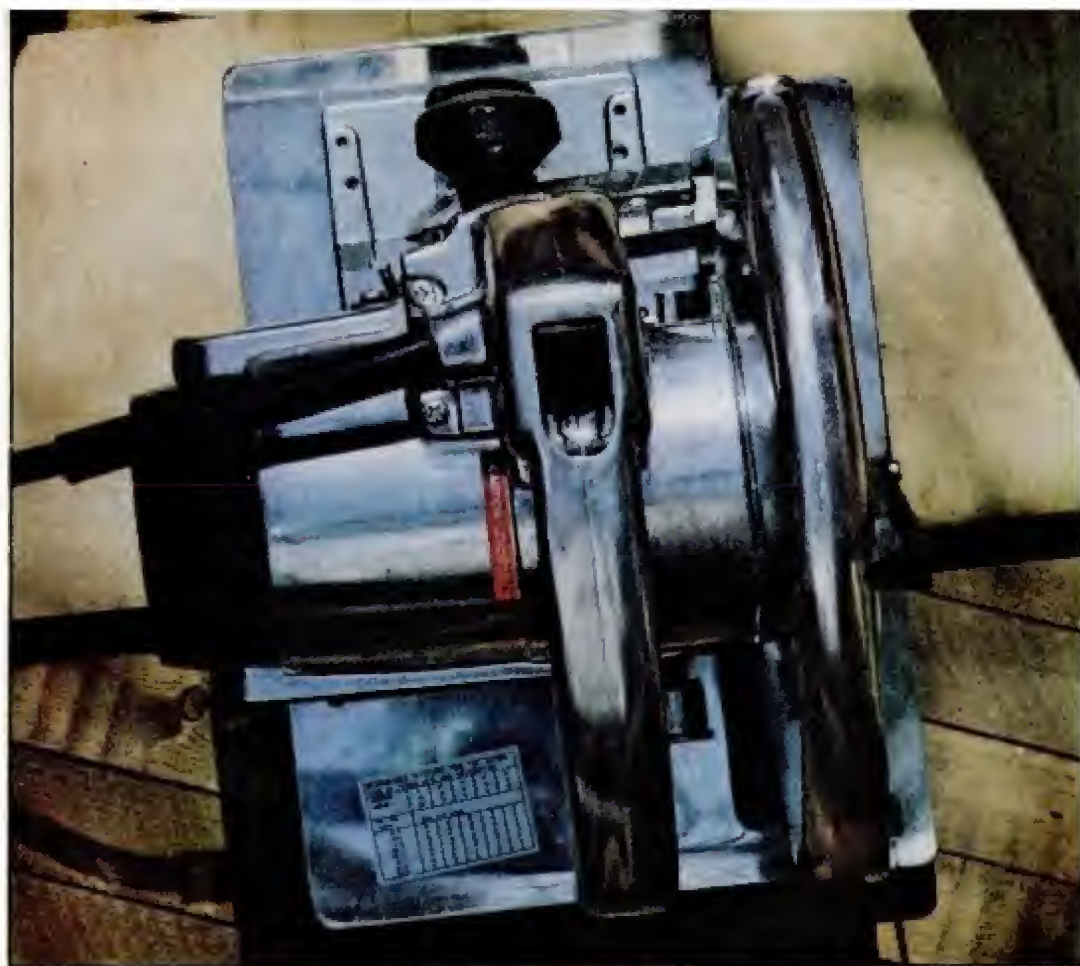
With a 7¼-in. saw you can cut through 2-in. stock effortlessly—even when the saw is set to cut at a 45° bevel. Ordinarily, this is the heaviest stock you will work with. When you must cut heavier stock such as a 4x4, you can do it with two passes as seen on these pages.

Most circular-saw motors are of the universal type that operate at

Getting the saw ready



Holding blade against wood prevents movement as arbor nut is tightened.

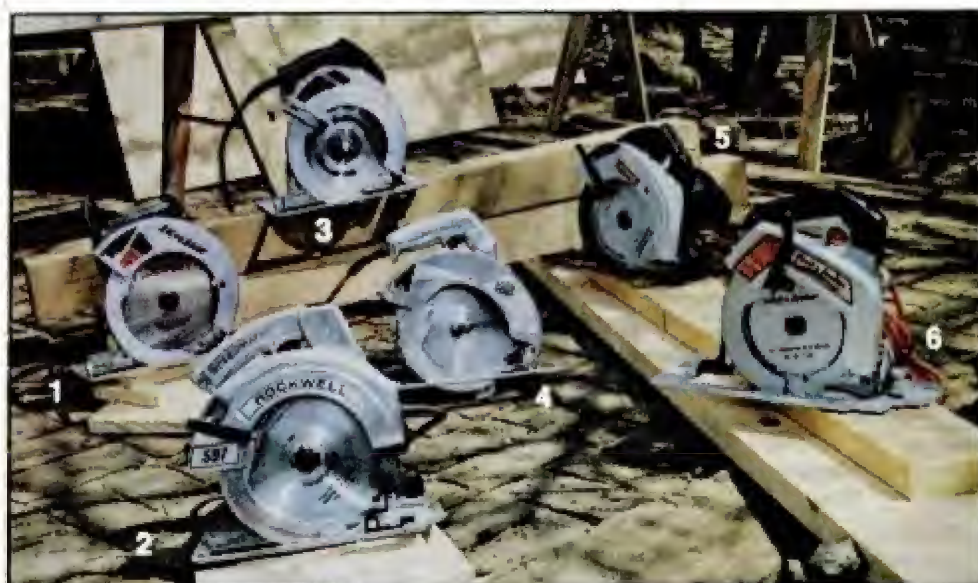


If used properly, a circular saw will quickly become one of your most valued power tools. Important points to check when buying a saw are depth of cut, horsepower and heft (how the tool feels in your hand).

Saws grouped here were used for how-to photos on these pages. All saws performed faultlessly.

1. Skil model No. 537, \$50;
2. Rockwell No. 597 AK, \$135;
3. Shopmate 1875, \$35;
4. Stanley No. 80278, \$95;
5. Sears Craftsman No. 9 H 1182, about \$48;
6. Black & Decker No. 7310, \$40.

Some saws are available in what manufacturers call "kits"; this simply means that the saw comes in a fitted box for storage and carrying convenience. For most users, the kit makes good sense.

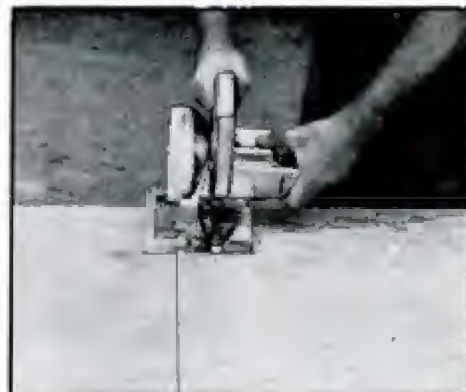


Photos: Abe Dulberg and the author

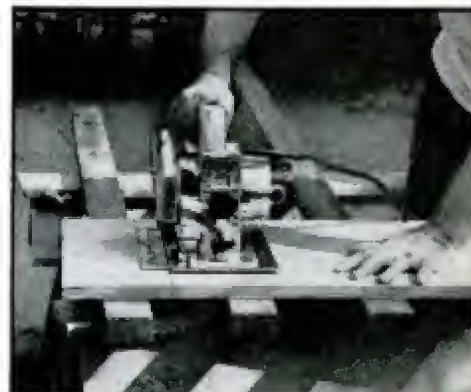
and using it properly



To determine blade depth, place saw on stock to be cut, use minimal projection.



For safety, saw weight should be on work-piece, not cutoff. User stands to one side.



Good job table: Two sawhorses and three 2x3s. Cutoff is over single 2x3.

Basic cutting techniques



Correct saw-holding technique is to clamp work and use both hands when possible.



Impromptu rip guide—thumb and index finger squeeze saw shoe, travel board edge.



To rip narrow piece accurately, lock the rip guide in place, make it ride work edge.



Some miter guides are adjustable for angle-cutting. When possible, clamp guide.



Compound-angle cut is made by setting saw at desired bevel, using the miter guide.



To cut plywood sheets, you can use a 4-ft. T-square clamped to the workpiece.

voltages within 5 percent above or below that indicated on the tool's specification plate. Never operate the saw at voltages beyond these limits. Also check the plate for the type of power circuit on which it is designed to operate. Many saws can be used on both a.c. and ac.-d.c.

Practice good safety

To protect yourself from electric shock, work only with a tool that is either grounded or double-insulated. If not of the double-insulated variety, your saw should come with a three-prong grounding plug to fit a grounding receptacle. If you must use an extension cord, use only a three-conductor type so a continuous grounding circuit is provided from outlet to power saw. Also, make certain that the conductor size of the cord is large enough to prevent an excessive voltage drop, which can do permanent damage to your saw.

Basic rules for use

All circular saws have retractable blade guards. As the saw is pushed into the work the guard retracts into the saw's upper blade housing—leaving the portion of the blade below the workpiece exposed. Develop the habit of making certain that the blade guard is operational before starting the saw—*every time*. You want to be

Other cuts you can make



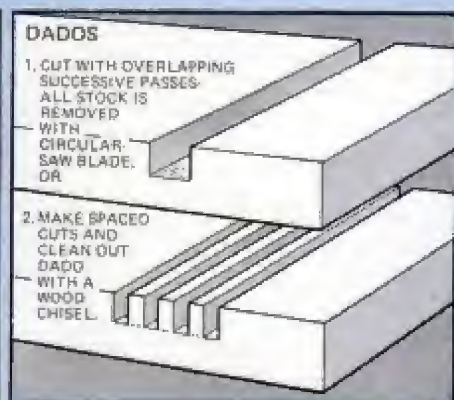
To join boards at angle, tack boards together and cut them simultaneously.



Cut this way, boards will fit perfectly, even if you stray from cutting line.



Two grooving techniques (above and right): Make overlapping passes . . .



Or rough out dado with spaced kerfs, finish groove by cleaning with chisel.



When you crosscut rough work, rigidly positioned thumb can be a good guide.



If neatness counts, use a miter guide. This one is from Black & Decker.



Be sure of accuracy on long cuts with a tacked-on guide (1x2 furring here).



Use a slow feed for bevel cutting because the saw tends to drift away from guide.

certain that the guard snaps back to its lower position before setting down with a spinning blade. *Never, under any circumstances, remove the blade guard from your saw.*

Always keep the saw away from your body when the blade is spinning, and *never* walk away from the tool while the blade is still in motion. And don't forget this (very) basic rule—always disconnect power before changing blades.

Finally, read the manufacturer's manual before using the tool. If the saw boasts any special features—an antikickback clutch, for example—you owe it to yourself to fully understand its workings so you can take advantage of all safety features.

Selecting a saw

In broadest terms, three factors will affect your decision when picking a saw:

- The materials that you will work with most often.
- Comfort.
- Cost.

Materials. Obviously, you need a saw with extra power if you intend to use it primarily to cut concrete or steel. But there's no need to pay

(Please turn to page 106)



To cut edge rabbet, make the first pass with a guide temporarily nailed to work.



Then clamp work in vise and tack guide to workbench top for the second pass.



Heavy workpiece can be cut by making passes from opposite sides of the board.



If saw must ride cutoff portion, clamp work securely, hold tool with two hands.



Plunge cut is made by slowly lowering the spinning blade into marked workpiece.



Before cutting fourth line, tack support strip to keep piece from binding blade.

Seamless flooring you can install yourself

by Bill Hartford and Harry Wicks

Luxurious look of wood parquet is captured in this seamless sheet vinyl. Do-it-yourselfers can install it.



Before dramatic change, cracked asphalt tiles covered the floor.



Resilient flooring has come a long way. The material is now supple, cushioned, won't crack when twisted or bent, and comes up to 12 ft. wide, making seamless installations in many rooms definitely possible for do-it-yourselfers. Perhaps the best news is the price. GAF Corp.'s Gafstar Foamcraft line sells for about \$5.95 per sq. yd. (uninstalled), making it possible to do a room like this one for under \$100. To cover this floor, we used a 12x12-ft. sheet of Londonderry Teak: Its color and embossed texture closely resemble real wood parquet flooring.

Moisture caused the existing asphalt tiles on the concrete slab to separate in several places. Besides being just plain ugly, they were cracked when the old slab settled and

broke away from the foundation. The idea of wall-to-wall carpeting was quickly discarded because this would have decreased the efficiency of the slab's radiant heating to a point that would have caused the fuel bills to skyrocket.

Preparing the floor

Because some tiles were loose, all were removed. If they had been tightly bonded to the slab, the new floor could have been laid right over them. Low spots, cracks and the gaping crack mentioned earlier were then filled with GAF's Flor-Fix, a leveling and patching compound.

Cutting sheet vinyl

You can use scissors or a knife to cut the material roughly to room

shape and about 3 in. oversize in all directions. To facilitate cutting, we transferred dimensions to the reverse side where following the line is easier.

Laying the sheet

It goes down without adhesive; start at the longest straight wall in the room by butting the vinyl against the wall. Unroll it across the room, allowing the material to curve up the remaining three walls. Next, hold excess firmly in place and trim to fit with a sharp knife. Finally, replace the shoe molding as shown below.

For additional Foamcraft buying information, write to: GAF Corp., Floor Products, Code 821, Box 1121, Radio City Station, New York, N.Y. 10019. ★ ★ ★



Old tiles are removed from concrete slab with stiff-blade scraper, propane torch.



Next, low spots and cracks are filled with GAF's Flor-Fix, which dries quickly.



Using a sharp utility knife, sheet vinyl is cut slightly larger than room size.

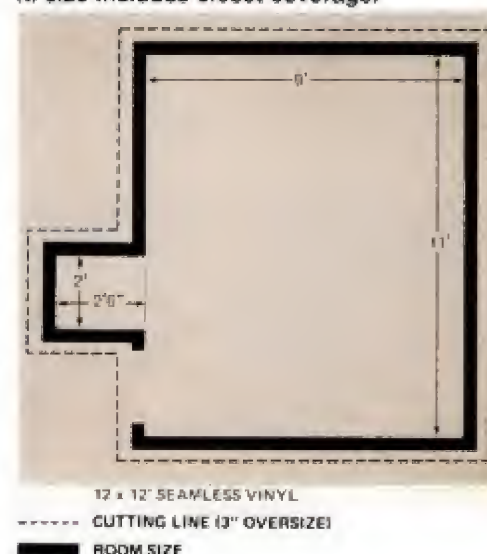


Oversize floor covering is laid to curve up three walls, then is trimmed to size.



Scrap of vinyl maintains expansion gap above flooring as shoe mold is replaced.

9x11-ft. room was covered with one piece cut from 12x12 sheet. The 11½ x12-ft. size includes closet coverage.



Coffee table slide viewer you can build

This contemporary table leads a double life. With its illuminated top, it boasts color-correct slide viewing.



Nailing jig cut from scrap helps align side pieces with the end section.



Recess clearance required for the rewind mechanism, using a router or chisel.



To assemble the table, use glue and lagscrews turned into predrilled holes.

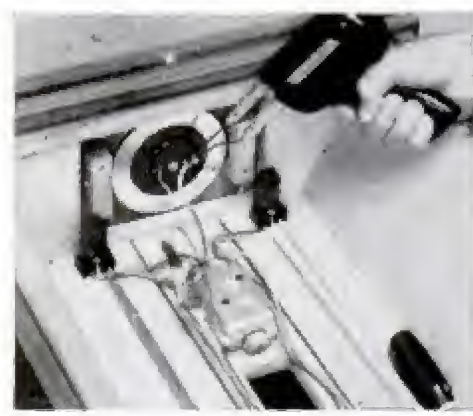


Mount rewind mechanism to blocks which have been fastened to the end section.

If you shoot slides seriously, you need a light box to sort them on. Commercially made slide-sorter boxes are available (see *Trim the Fat From Your Vacation Slide Shows*, page 124, Dec. 74), but they have several shortcomings. For one, they don't hold very many slides. Also, their reddish light gives a false impression of your slides' color. And finally they're not attractive enough to leave out in plain sight between your sorting sessions.

This light box, though, is another story altogether. Its 900-sq.-in. viewing surface can hold more than 200 2x2-in. slides—many more than most people shoot on even the longest vacation. Its light—if you use the recommended fluorescent tubes or their exact equivalents—is the same 5000 K (Kelvin) bluish-white light that professional photographers and engravers use to judge slide color quality.

The bonus here is that this slide



Before assembly, pass line cord through opening. Solder leads to rewind terminals.



End view with cover in place. Notice the aluminum angles under light tubes.



Completed wired table. Two openings in bottom are for ventilation.

Color photos: Benn Mitchell
How-to photos: John Capotosto



Elegant coffee table is a large functional slide viewer.

viewer has been built into the top of a handsome, modern coffee table.

The lighting of this tabletop is exceptionally even, thanks to the reflector design which is our version of those used in the Matrix line of professional light boxes. We've added two additional features to the Matrix design: a dimmer—so you can use the light to illuminate glassware and decorative objects with a soft, dramatic glow—and a heavy glass top which lets you set down glasses and the like without fear of scratching the translucent Plexiglas beneath. This feature also lets you put large, unmounted transparencies on semipermanent display between the glass and sheet-acrylic layers.

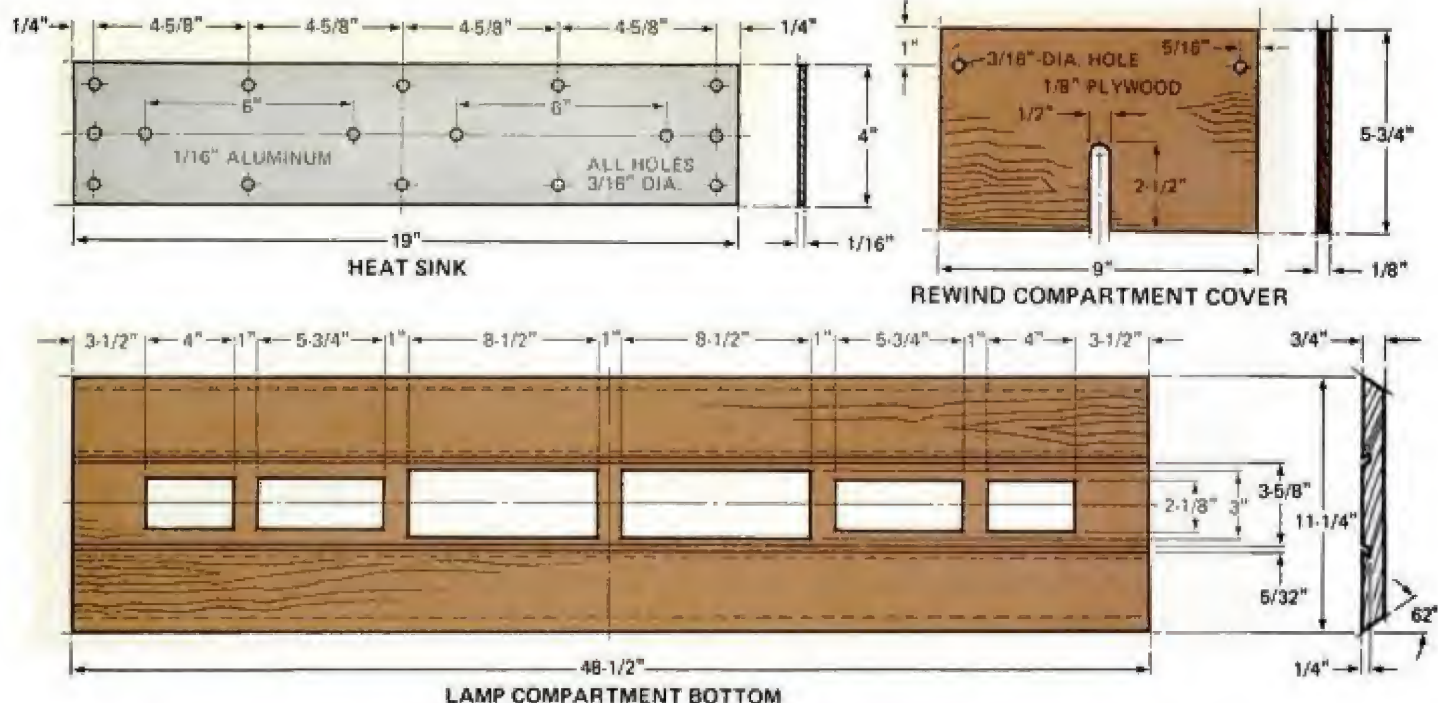
Notice that neither the glass nor Plexiglas top is provided with finger holes. These can be drilled at both ends if desired. Our feeling, however, was to keep the

box inside dust free by eliminating any holes, and using a large suction cup (or tipping the table slightly) whenever it's necessary to remove the glass to change a bulb.

Building the table

Start by laying out all parts on a 4x8-ft. sheet of plywood. Using a portable saw or sabre saw, cut out the parts, making certain that they're slightly oversize. Then recut the pieces to exact size on your table or radial saw using a plywood blade to assure a smooth cut. At this stage, you should have four endpieces, each 21 5/16 in. wide and 18 in. high. You can also rip the sidepieces to a width of 9 1/4 in.

Rip the edge strips of solid material of the same species as the plywood used. (On the table shown, we used birch cabinet-grade plywood, so edge strips are of



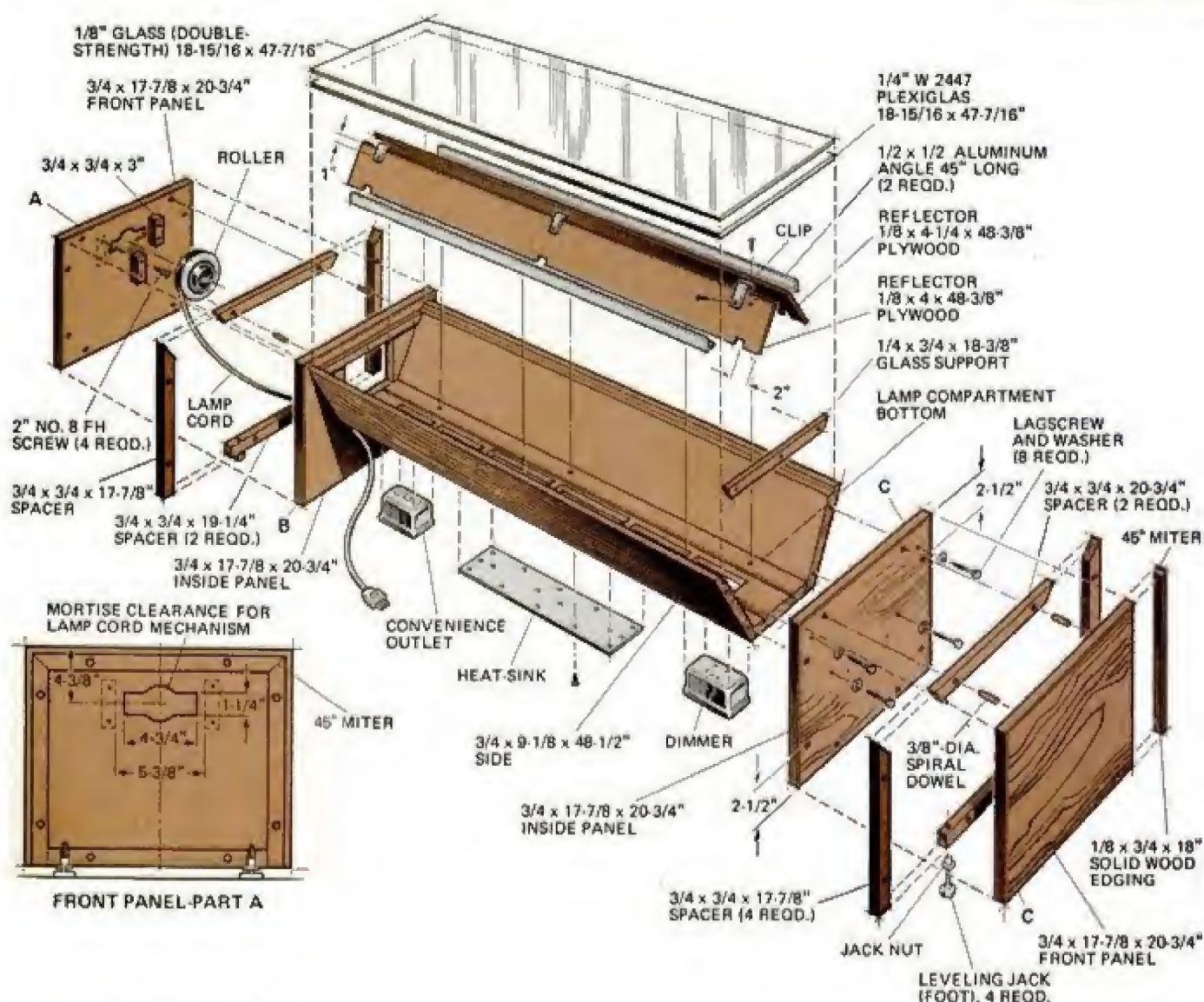
solid birch. Make each of these edge strips about 1/8 in. thick (this dimension is not critical); then glue to all exposed edges. Next set your table-saw blade to 28° and bevel one edge of a 1-in.-wide piece of solid stock.

This will be used to trim one edge of the side pieces.

Now glue all edge strips to the table ends and sides. During this step, a few well-placed brads will keep the pieces from shifting about

during the gluing and clamping operation. If desired, solid edge strips can be eliminated and matching flexible wood tape can be applied using contact cement.

When the glue has dried, use a [\(Please turn to page 110\)](#)





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200 HP.

Evinrude introduces a new V-6 motor so powerful it cruises efficiently faster than most motors can run...

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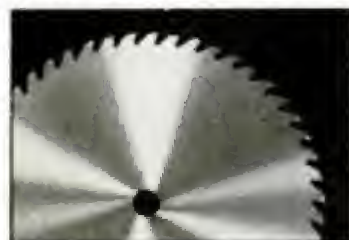
And an all-new super "35" — a motor that does so many things so well it could become the largest selling motor of all time.

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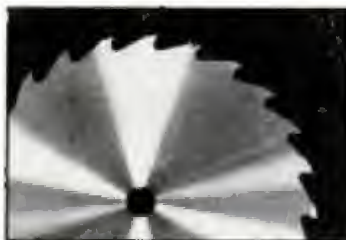
General-use saw blades



All-purpose



Smooth-cut combination



Two combination blades—note tooth shapes



Finishing blades



Thin-rim satin cut



Planer

for all that power if your work will be confined mostly to woods $\frac{1}{2}$ to $1\frac{1}{2}$ in. thick.

Comfort. The tool has to feel good to you—you're the one who will use it. Never buy a tool without some type of personal-use test—even if it is strictly a simulation-use in the store. Since you spend a great deal of time bending over to pick up or put down a circular saw, its weight is extra important.

Cost. Make no mistake about the fact that you get what you pay for. A \$20 saw, for example, will indeed cut 2x4s, but don't expect it to do this all day and survive. A \$75 tool will.

Get to know your new saw

Be aware that the saw must always be firmly held, and that a two-hand grip is best (one hand on trigger and handle, the other on the housing). If you must use one hand to hold the work, keep that hand well away from the cutting line.

Also, keep your body to the side of the cutting line (in case there is a kickback). Make some practice cuts with scrap wood clamped so that you can develop your confidence working

with the saw. Set the blade to project about $\frac{1}{8}$ -in. or so below the work. For a good worktable setup, use two sawhorses, and three lengths of two-by stock as shown on page 97.

Rate of feed is important: Never push the saw so there is a strain on its motor. The density of material being cut and the type of blade used dictate the feed rate. As a rule of thumb, if in doubt, feed slowly.

You must keep a circular saw on the cutting line or it might kick back. Green lumber, which tends to close the kerf behind the blade, also causes kickbacks.

Since there is *always* a possibility of a kickback, many makers now offer saws with antikickback devices (also called slip-clutches). To assure this feature being operative, the blade and blade-holding screw must be installed properly in the saw.

Basic cutting techniques

Though it is both possible and acceptable to do freehand cutting, it is a must that guides be used when accurate cuts are required.

To determine the distance from a cutting line that a guide should be

(Please turn to page 108)

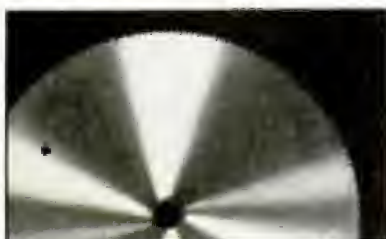
Plywood blades



Sears' ply-tooth



Skil's plywood



Rockwell's plywood

Rip and crosscut blades



Standard rip



Fine-tooth crosscut



Smooth crosscut



Teflon-coated crosscut

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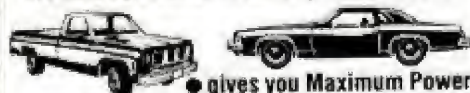
Filter King: 18 mg. "tar," 1.2 mg. nicotine;
10's: 19 mg. "tar," 1.4 mg. nicotine Av. per cigarette by FTC Method
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clamped, push the saw an inch or so into scrap stock, then turn the saw off. Before removing the saw, and after the blade stops spinning, mark the left edge of the shoe on the wood. Next, remove the saw and measure the distance from saw kerf to pencil mark: This is your saw's offset—with the blade in the saw at this time. This dimension can vary slightly depending upon the blade used.

To decide in which direction to

Miters and bevels. In order to do these accurately, you should have a miter guide. When cutting a bevel or compound angle, use an extra-slow feed.

About blades

Most makers package a combination blade with their saws. These will let you handle most of your cutting initially. But as you progress into a wider variety of jobs, you would be wise to add various blades as the need for each type arises. And always purchase top-quality blades—with care, they will last indefinitely.

Besides the combination blade, plan to add at least one rip blade, a fine-tooth plywood blade and, possibly, a carbide-tipped blade. Though the last-mentioned costs more initially, it will save you money if you do a lot of rough cutting because it will last a long time between sharpenings. A conventional blade may need re-sharpening after just several hours work.

Use absolutely-sharp blades only: A dull one puts undue strain on the saw motor and is a safety hazard to boot. Always clean off gum and pitch buildup; it can be removed with kerosene or water. Remove the blade from the saw for cleaning.

Preventive maintenance

To keep your saw in tip-top running condition, follow these three suggestions:

1. After each use, disconnect the saw from power and clean all sawdust and dirt from around air vents. Wipe off the line cord to prevent its deterioration by oil or grease.

2. Follow the manufacturer's instructions for lubricating.

3. Depending on the number of hours of usage, anywhere from six months to a year after buying your saw, take it to the manufacturer's authorized service center for a check-up. In particular, ask the serviceman to inspect the brushes, test the electrical system, and check any sealed gearboxes that may require relubrication. ★ ★ ★

Special-purpose blades



Eight-tooth carbide



Iron and steel cutting



Masonry (Stanley)

cut, remember that it is best to have the saw's weight on the workpiece instead of on the cutoff portion. If the shoe must ride the cutoff, hold the saw with both hands. To do this, you should clamp the workpiece.

Crosscutting. Cutting across the grain usually causes wood fibers to tear and lift. A slower feed rate reduces this effect; but for absolute smoothness, it's best to use one of the smooth or finish-cut blades shown.

Ripping. Cutting with the grain creates fewer problems than cross-cutting, thus it is possible to use larger-toothed blades which have much greater bite and permit faster cutting.

To rip narrow pieces, it is advisable to use a rip guide. For ripping large sheets, a straight piece of 1x3 should be clamped or tacked to the material being cut.

CIRCULAR SAW SAFETY

- Do use only properly grounded tools.
- Do read the owner's manual carefully.
- Do keep blade guard in working order.
- Do wear safety glasses.
- Don't force the tool. Work at the speed for which it is designed.
- Don't abuse the line cord—disconnect it properly.
- Don't leave an unused tool plugged in.
- Don't use saw in damp locations.



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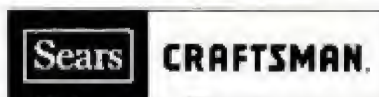


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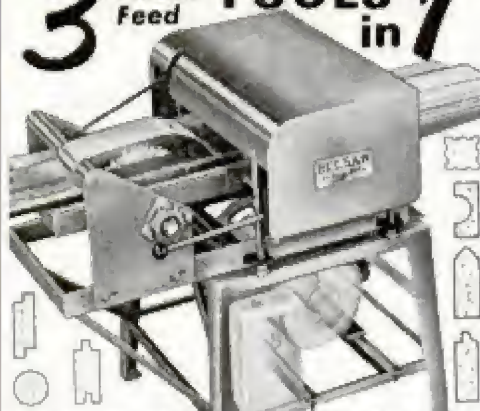
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CARS OF THE 1980s

(Continued from page 51)

about to convert massive amounts of engine capacity to a new type engine overnight.

Chrysler: Chrysler's feeling about the Wankel is that it's dirty and not anywhere near clean enough for use in a car at this stage of its development. The steam car has been repeatedly discredited—again, in its current state of development. The diesel is heavy and very expensive in terms of the amount of horsepower it yields. But the diesel gives excellent economy, it's clean and has a very long service life. The diesel might have some long-term future. But so far as we know, we'll stay with the conventional piston engine—with substantial improvements.

Ford: As we see it now, we will not have a different engine of any type before the mid or late 1980s. The two that look most promising to use at the moment are the Stirling and the gas turbine. Both require some important work from an operational standpoint and a production point of view. Short of that, we will continue to refine and improve the piston engine.

General Motors: We think the next 10 years will see modifications of the conventional spark-ignition engine. The possible exception is development of a lightweight diesel for passenger cars, but that depends on what emission and/or fuel economy requirements we have to meet. Looking beyond 1985, battery powered cars may be available for special types of service, along with small gas turbines.

■ **Will most cars of the 1980s have front-wheel drive?**

American Motors: There will be an increase in use of front-wheel drive on cars of the 1980s, particularly small cars, but my guess would be that most cars will not have front-wheel drive. The space efficiency is good, because you get all the mechanics up front and get rid of the tunnel. But you're talking big bucks for retooling to go front-wheel drive on all cars, because you have to retool the transmission and differential.

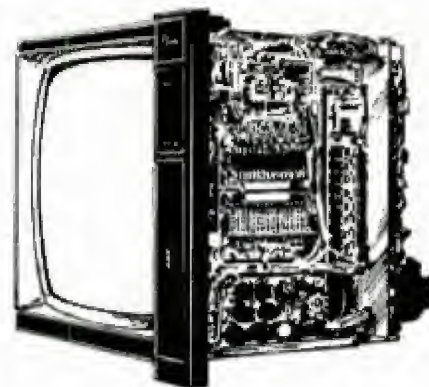
Chrysler: Front-wheel drive on the smaller cars, yes. On the larger cars, I doubt it.

Ford: As you get into smaller, more compact cars below the Pinto, Vega size, front-wheel drive starts to make sense. Not for cars above that.

General Motors: Front engine, front-wheel drive, as well as rear engine, rear-wheel drive, offers improved passenger space. This be-

(Please turn to page 116)

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enroll students by mail only. We pass the savings along to you in the form of low tuition fees, extras like a cabinet for the TV, a solid-state radio you learn on as you build, and actual instrument kits for servicing TVs . . . triggered sweep oscilloscope, integrated circuit TV pattern generator, and 3½ digit digital multimeter. You can pay hundreds of dollars more for a similar course and not get a nickel's worth more in training and equipment.

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CARS OF THE 1980s

(Continued from page 112)

comes more important as cars are scaled down in size. We think you will see more of both types.

■ **How about service? Are cars going to become easier and cheaper to service? Or are they going to be more complex so they will be more difficult and more costly to service?**

American Motors: We'd like to be able to say cars are going to become easier and cheaper for the customer to service. It's a popular idea emotionally. But once you get beyond a basic list of self-service items—oil change, filter change and plugs—you rapidly move away from what is practical for most customers to handle on their own. We think a better way to go is (1) make the dealer more efficient so he can give better service and (2) build more reliability in the car. What we'd really like to do is lock the hood for 50,000 miles.

Chrysler: We're making a substantial effort to reduce the incidental types of service. Service that involves taking your car in to a dealer, leaving it, having a mechanic work on it, then picking it up at night. That type of service is going to become easier and less expensive from a labor standpoint. But I think as we get into more sophisticated components—computers and electronic elements—there will be more push-pull service. Where the whole unit is removed and replaced with a new unit, instead of trying to Mickey Mouse it with a soldering iron. If that's the way it goes, the cost of the unit will be more, but the cost of labor will be less.

Ford: I have to give you a mixed answer. We watch the reliability of our cars very closely. We track the number of repairs a car line requires per 100 cars in the field. Then we put things in our program to reduce the number of repairs. This is a continuing battle because we keep adding options and things that make the car more complex so there are more opportunities for a part to fail or malfunction. We will have to increase the reliability factor as we go to electronic controls. But the more hardware you add, the more new things you put on a car, the more problems you make for yourself from a service standpoint.

General Motors: Cars will become more complex, but the mechanic's job of servicing them will be simplified. The reason is modular parts that can be removed and replaced, either with a new unit or a repaired or remanufactured unit. We look for the trend to less maintenance to continue. ★★★



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says Glen Johnson,
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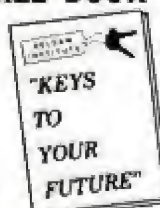
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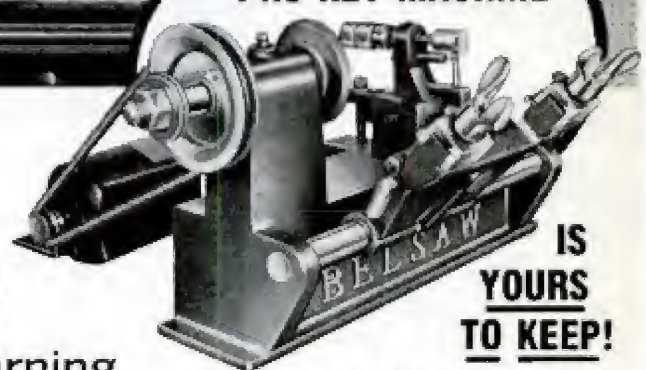
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Button up your underarm.



MINI GLIDER YOU CAN BUILD (Continued from page 80)

ideal answer for those who have long wished to fly but can't afford a regular sailplane or airplane and have no intention of jumping off cliffs strapped to a fabric kite.

Marske's creation, called the Monarch, is unique in many ways. It is virtually a flying wing, with no long fuselage and no horizontal tail. All control surfaces are within the wing itself, and the cockpit consists of a small pod slung underneath. Over the years, one of the great fears of the flying wing concept has been that the wing, with nothing to counterbalance it, would tumble over out of control—like a fluttering leaf. This can't happen with the Monarch, maintains Marske, an aeronautical engineer who's been building and flying gliders since he was a teen-ager.

The cockpit pod, cantilevered out below and ahead of the wing, acts as a counterweight and puts the center of gravity so far forward the wing tends to "weathervane," streamlining itself into the airflow no matter what the attitude of the craft.

Eliminating the conventional fuselage and tail reduces weight drastically, producing an ultralight ship easy to assemble, store and transport.

Only 200 pounds, the Monarch weighs about one-third that of a standard single-place sailplane.

Even more surprising is the Monarch's novel control arrangement. There is no rudder—only a fixed vertical stabilizer. Elevator panels, built in the trailing edge of the wing at the center, provide up and down movement. In addition to conventional wingtip ailerons, there are mid-span spoiler flaps that open outward into the airstream both above and below the wing on each side.

These spoilers serve two functions. When both sets are used together, they kill partial lift over the wing, increasing the wing's sink rate but without changing the ship's nose-up or nose-down attitude. Thus they enable you to lose altitude without gaining speed. This gives you precise control over speed and descent rate when making landings.

For steering, the spoilers are used individually and produce essentially the same effect as a rudder. Open out the set on the left side of the wing and their drag swings the ship to the left—and vice versa for a right-hand turn. The ailerons are also used in conjunction with the spoilers to pro-

vide the added roll (bank) necessary for a good, clean banking turn.

Another unconventional touch is the control stick—it hangs down into the cockpit from overhead instead of protruding up from the floor. The stick operates elevator and ailerons in the usual way, but attaching it directly to the wing overhead eliminates long runs of control cable and complex linkage arrangements.

The Monarch is small by conventional standards—only 11½ feet long with a wingspan of 39 feet (full-size sailplanes have wingspans of 50 feet or more). That 39-foot span is important, though—it's the maximum width Marske could use and still make his mini soarer easily storable. With a 39-foot span, each half-wing section is kept to under 19½ feet—just short enough to fit in a standard 20-foot garage. The wings are quickly removable so they and the thin fuselage pod can be stacked in a garage when not in use or readily trailered to a launching site. Assembly time takes 10 to 15 minutes.

The Monarch has a speed range of about 30 to 75 mph. Its glide ratio is 18 to 1—18 feet of forward flight for every foot of drop. That's pretty good, though it's somewhat under the 23-to-1 ratio of a typical primary trainer and considerably below the 45-to-1 and higher ratios of special high-performance sailplanes. It's enough, in any case, to give you a good, safe operating range. At an altitude of 3000 feet, you could stray 10 miles and still make it back on glide alone, assuming no thermals (updrafts) to ride on. At 5000 feet, you could soar more than 17 miles!

Basic construction of the Monarch is molded fiberglass for the fuselage pod, with Styrofoam wing ribs covered with Dacron. The pod comes premolded in two halves you merely bond together. The wing structure and control surfaces, however, must be built up piece by piece. Estimated construction time is 200 hours.

Exact prices are not yet definite, but current plans are to market the Monarch in two separate kit packages. The basic kit will include all fiberglass parts, fuselage pod, seat and control panel for about \$1395. A supplementary kit, about \$450, will contain hardware such as control linkages, hinges and all other metal parts required. This brings total kit cost to about \$1845. You can also build the ship from plans. These sell for \$60 a set and include many full-scale drawings and templates to simplify construction. For starters, a basic information package costs \$2. Address requests to Marske Aircraft Corp., 130 Crestwood Drive, Michigan City, Ind. 46360. ★★★

moderately cold winters in mid-U.S. latitudes: The collector surface should equal at least half the square footage of the heated area of your house. If you heat 2000 square feet, the collector area should cover 1000.

5. How big a storage tank? The heated square footage of your house multiplied by five will give you the number of gallons of sun-warmed water you must store to see you through about three sunless winter days in a row in mid-U.S. latitudes. A 2000-square-foot heated area calls for a 10,000-gallon tank—or 5000 gallons plus an equal volume of rocks.

6. Check collector and storage capacity against Weather Bureau figures for the average number of sunny days in your area per year. Solar-efficiency claims are usually based on an assumed number of sunny days—and the less sun you have, the less practical a solar furnace will be for you. Also check on your home's average loss of B.T.U.s per degree day (your fuel supplier can provide this information). To be efficient, a solar system must be able to make up a good portion of this heat loss—though not even the best will do it completely. In mid-U.S. latitudes, a good solar design will supply a maximum of about 80 percent of the season's heating needs, so you'll need a back-up system for part-time use. However, a collector supplying only 50 percent of your heating needs will still cut your fuel bills in half—so keep that in mind too.

7. Plan on maximum insulation to make the most of solar heating. Any reputable dealer will emphasize the need for generous insulation to reduce B.T.U. requirements and cut heat loss. Ask for his recommendations—and an estimate of cost if additional insulation is required.

8. Before you plunge, check local building codes. You may not be allowed to put up a collector on your house or in your yard.

9. Be prepared for extras by the gross. Water-circulating systems require a differential thermostat (\$65 to \$165) to operate a 1/2th to 1/3rd-hp pump motor (\$80 to \$120). Regular thermostatic controls are needed for the blower, and a heat exchanger will be required in the plenum chamber for hot-air systems.

So check things out thoroughly with a good, sharp pencil. And don't forget you're a pioneer of sorts—unexpected disappointments can, and probably will, occur. If you're doubtful, wait a while—anything may happen in the next few minutes in the solar energy field. ★★★



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Mennen Prop: Cool, refreshing electric pre-shave that props-up your beard and conditions your skin for closer, smoother shaves.

Prop-up your whiskers.



GO-ANYWHERE FLIERS OF THE FERRY SERVICE (Continued from page 71)

and that one of us didn't have a working compass. 'We have two directional gyros, he said, and if just one goes out, some of our pilots will scratch a flight.' "

After the darkness of the mountains, Harrisburg looks like a city having a big Saturday night. We land, gas up and prepare to continue on—then more trouble.

"I don't like that dewpoint-temperature spread; too close," says Ron.

"But let's push on. We can always come back."

When we're airborne, Ron calls ahead for Morristown weather.

"Nothing on Morristown yet. Teterboro 600, scattered, visibility 7, the ceiling is all ragged."

Ron dodges patches of fog and we slam into rough air. He points to a highway on the chart. It's directly beneath us.

"We'll keep that in view. If this weather gets worse and we have to drop lower, we'll be clear of any hills if we're near the road."

He points to an airport through a break in the clouds. "That's Solberg and it's open. We have this to fall back to."

We fly on. Ron has been at it for

12 hours—a pretty good day's work on a thin sandwich and a glass of milk—and we're again being bounced by turbulence. He's tantalizingly close to his goal. But he may have to turn back, put down and pay for a motel and meals. He'll take no foolish chances, but he won't quit until the game is over. He dials Morristown.

"Cessna 416 Victor, continue inbound. We're now VFR, 1000 overcast and visibility 9 miles."

Ron acknowledges and whoops "Hoo-ray! We're going to make it all the way! Put it there!"

We shake hands and I accept his congratulations—for never having to use the air-sickness bag.

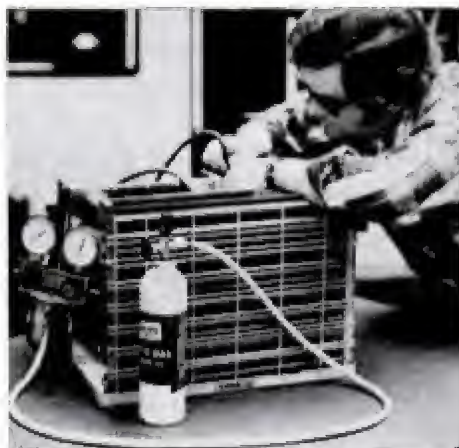
We land a few minutes later and Ron delivers the 150 to the Cessna distributor. We leave her with 14 hours on the hour meter; we've flown 1200 miles; it's 9:35 p.m. We grab a rented car and head for New York's Kennedy Airport. With luck, Ron can make the last flight to Chicago and catch a 1:00 a.m. plane to Wichita. He'll be home by 3:00 a.m. As we parted, the very last thing he told me was: "I like ferry work. It gives me a chance to relax on weekends." ★★★

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FROM READERS

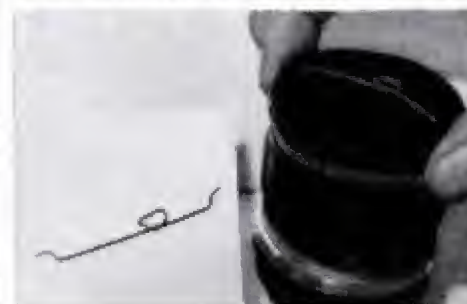
Washers improve release grip



Two large washers, lightly soldered to a cable release as shown, give it a larger and surer grip.

—Ken Patterson, Regina, Sask.

Spring holds lens cap on



Lens caps fall off—but not mine: mine fit so snugly I can even lift a lens by its cap (top photo). The secret is a tiny spring I bent from .025-in. diameter Nichrome wire. The loop at the center (lower photo) provides the spring action, and the ends, bent perpendicular to this loop, engage the lens's inner threads. Total length, after bending, should be just less than the lens cap's inner diameter. Punch the cap to hold the bent ends.

To install the cap, pull the loop aside with one finger to retract the spring ends, and press the cover in place.—Emery J. Loisel, Burlington, Mass.



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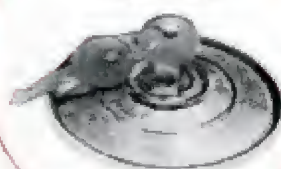
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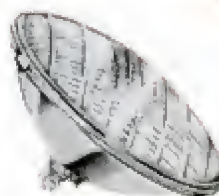


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ft. square, painting 2-in. strips at corners and along door and window frames when these fall within the area. As shown in a drawing on page 95, butt edges should be painted before you cover weather faces of siding.

How not to fall

You're not saving money on a paint job just to spend it on doctor and hospital bills, so work safely with ladders. Never overreach. Never climb above the third rung from the

top. Keep one hand on the ladder at all times, or hook your leg over a rung. Keep adequate overlap in extension ladders. Place ladder base away from the wall one-fourth the distance the ladder is reaching up the wall. ★ ★ ★

Moisture—paint's enemy

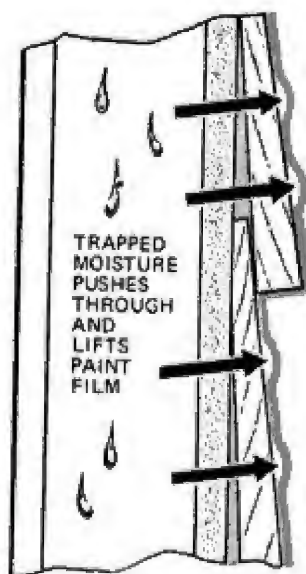
Hidden moisture from within your home can not only ruin a paint job, it can wreck an entire house. Rotted wood, soggy insulation and general

paint. Unless moisture is controlled, keeping your home painted will be an endless job.

You can help moisture escape merely by opening a window a bit to let vapor out of a steamed-up bathroom or kitchen. Exhaust fans have the same effect. In bathrooms, kitchens and laundry rooms, it's also wise to install ventilating louvers under window sills. These are 1-in.-diameter round vents, fitted in holes

bored through siding and sheathing. Moisture trapped in the attic can attack insulation there and seep down into walls. Installation of roof-end gable louvers and rooftop ventilators are your best bet to help circulate air and pull moisture out.

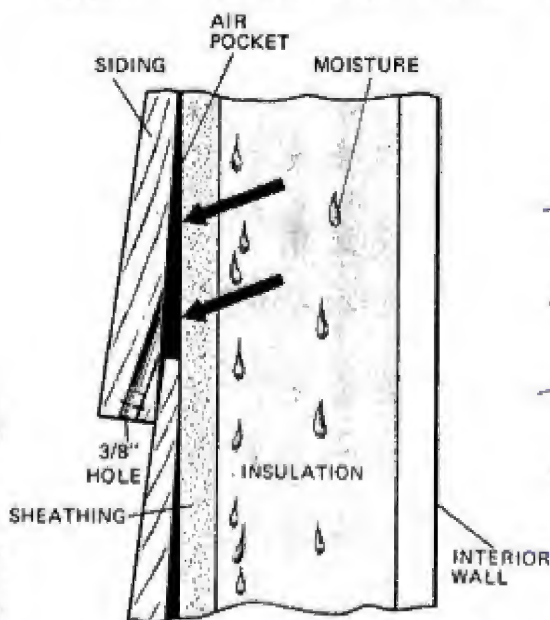
Probably the best corrective measure you can take to make sure your home is properly ventilated is to install special vents up under the lapped edges of the exterior siding.



Trapped moisture must escape. When there is no easy way out, it passes through the siding, lifting paint as it goes.

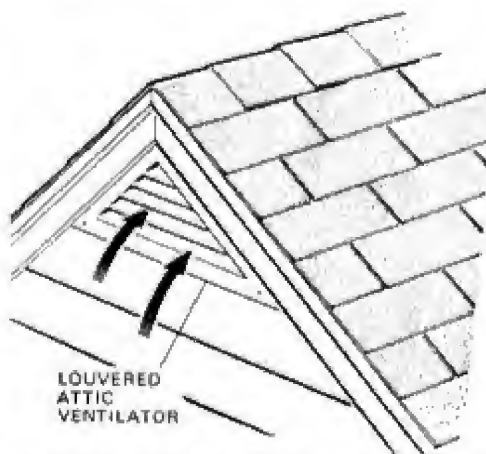
decay are extreme results of an uncorrected moisture problem in a poorly ventilated house. To remain sound, a house must "breathe" to allow excessive moisture to escape. Because moisture disappears into the outer walls from within, it's seldom noticed before it pushes its way through exterior siding and escapes, leaving behind a blistered and peeled paint film.

Not even the best constructed house is safe from moisture. Expansion and contraction of wood during drastic temperature changes may cause caulking to fall out. The foundation may settle, boards may split. Be watchful that moisture from outside does not enter open joints. Also, see that wood siding does not contact the ground. Moisture, like a caged animal, continually seeks to escape, and better built modern homes can be too-tight cages—insulation, tight-fitting storm doors and windows and superior caulking can leave inside moisture with no path of escape but directly through walls and

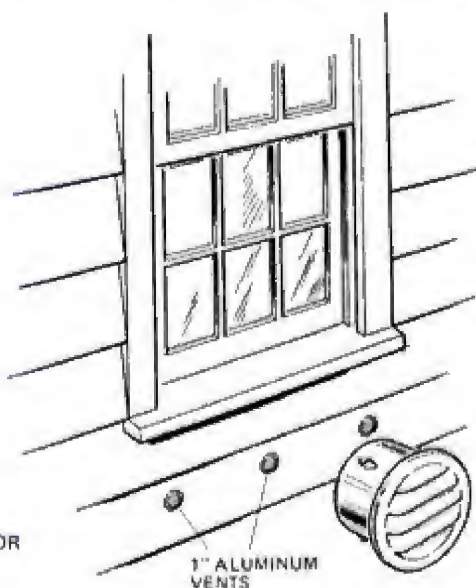


Art: Fred L. Wolf

"Breathing holes" drilled into air spaces behind siding allow moisture to escape before it attacks the painted surface.



Moisture control is secret of a peelproof paint job. Gable louvers will help circulate attic moisture and let it escape.



Siding vents will allow moisture trapped in exterior walls to escape freely without lifting and wrecking the paint.

providing "breathing holes" for moisture's escape. A special tool, designed for use with a portable drill, holds a drill bit at the correct angle to bore $\frac{3}{8}$ -in. holes up through siding edges.

With lapped bevel siding, holes are drilled through the siding and into the air pocket behind it, but not into the sheathing. With rabbeted siding which fits flat against sheathing, holes are drilled through both siding and sheathing. The holes are lined with plastic inserts designed to keep the holes open, while effectively blocking out insects. In badly peeled or blistered areas, these vents should be installed every 16 in. between studs. ★ ★ ★

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Beryllium	X	X			X
Carbon	X	X		X	X
Cast Iron	X	X			X
Composites	X	X	X		X
Composition Board			X	X	X
Fiberglass	X	X	X	X	X
Foamed Glass	X	X			X
Friction Materials	X	X	X	X	X
Glass	X	X			X
Hardened Steel	X	X			X
Honeycomb Materials					X
Marble, Natural	X	X	X		X
Marble, Synthetic	X	X	X	X	X
Plaster			X	X	
Plastic Laminates	X	X	X	X	X
Plywood			X	X	X
Stainless Steel	X	X	X		X
Stranded Cable	X	X			X
Superalloys, Iron-base	X	X			X
Superalloys, Nickel-base	X	X			X
Tempered Hardboard			X	X	X
Tires, Steel-reinforced					X
Titanium	X	X			X
Tile, Ceramic	X	X	X		X

*Requires coolant and variable-speed machine



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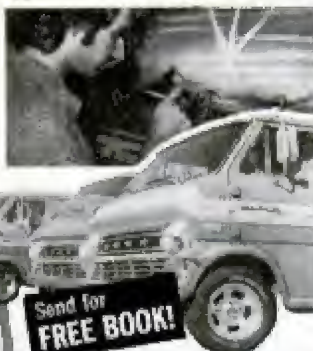
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IMPORTS AND MOTORSPORTS



British Beetle

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a complete car, set up and ready to paint, the price is \$3200. You can write Fiberfab at 548 Baldwin St., Bridgeville, Pa. 15017.

Sizzler for '76

Kawasaki's got a new four-stroke in the 1976 lineup. It's smaller than the 900-cc tourer and bigger than the 400-cc commuter. Called the KZ750, it's a vertical-twin sports machine with, naturally, 750-cc displacement. The engine is of a double-overhead-cam designs that employs a system of rotating counterweights to cancel out vibrations. Horsepower is given as 55 at 7000 rpm.

The 500-pound bike has disc



brakes front and rear, making it the first Kawasaki with this feature. Other conveniences include electric starting and turn signals that produce audible clicks so you don't forget to cancel after a turn. Other specifications include: length, 84.6 inches; seat height, 32.5 inches; fuel tank capacity, 3.5 gallons and transmission, five-speed.

Kawasaki has three more new models for '76: two trail machines, the KD80 and KD125, and an enduro, the KE175. Kawasaki Motors, Corp., 1062 McGaw Ave., Santa Ana, Calif. 92705.

Bike of another type

Speed usually isn't a concern for the owner of an electric motorcycle. But for Mike Corbin, designer of the one shown below, speed's part of the fun of being in the business of building bikes: He has set several speed records at the Bonneville Salt Flats with his electric machines. He's also in the business of "recycling bags";



that is, converting VW Beetles to the use of electric power. Write to him at Corbin-Gentry, Inc., 40 Maple St., Somersville, Conn. 06072.

Super-duper Vee

Looking for increased downforce and faster speed in the straights, Billy McConnell fitted his Essex Chemical Super Vee with a sports-car nose, side pontoons and wing, making it look more like a Gran Prix Formula 1 car than a Volkswagen-powered open-wheeler.



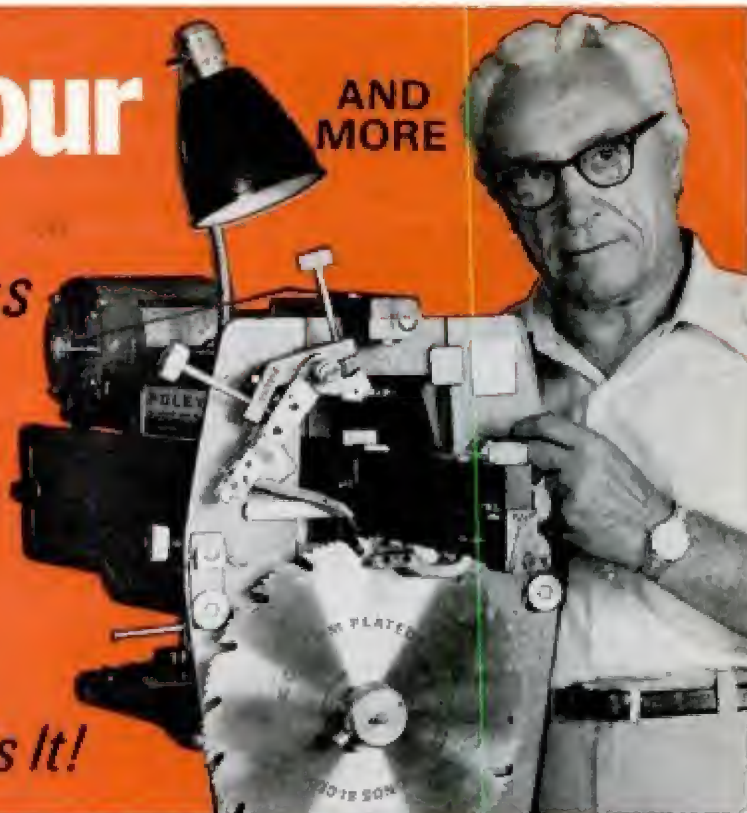
McConnell is one of the newcomers to the Robert Bosch VW
(Please turn to page 126)

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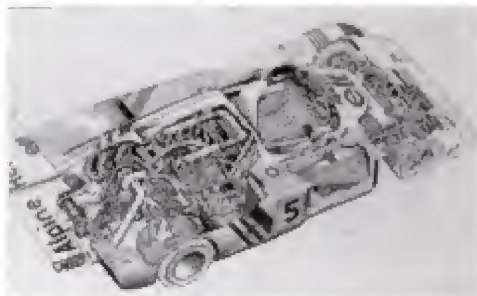
IMPORTS AND MOTORSPORTS

(Continued from page 124)

Gold Cup Series, but he's already looking ahead to challenge the leading drivers in the series and to have enough points to go into the finale at Daytona on Nov. 30 with a chance at winning the championship.

Racing's rewards

Renault roared into Watkins Glen with its turbocharged Alpines knowing that there was no way it could win the World Championship of Makes—Alfa Romeo already had the title clinched. The Renaults were the



fastest cars on the track for the Six Hours of Watkins Glen, but minor mechanical problems kept them from winning the race. One Alpine placed third—behind the unstoppable Alfa Romeo's that have been dominating the endurance racing events this season.

But the Manufacturers' Championship, as it's variously known, is more than just a series of races: it's a way of drawing attention to your cars. So, Renault was happy with its good show, and so was Alfa in continuing its domination of the series.

In addition, each of these manufacturers is involved in another race—to see who'll be first on the U.S. market with the excellent small cars each makes. The Renault 5 (*Imports and Motorsports*, Jan. '75, page 14) will be the French manufacturer's entry, and the Alfasud (shown here) will be Alfa Romeo's represen-



tative. The economical Alfasud will join the Alfetta sports models that have already arrived here. We'll report on driving the Alfettas in the November issue. ★ ★ ★

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Keith Hamill, Toronto, Can.

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George James Luzzi, Norwood, N.J.

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Edward H. McInroy, Honesdale, Pa.

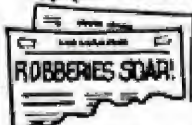
"First got interested in locksmithing as it is necessary for my job and there are so few locksmiths in the area. Enjoyed study as well as practical training."

Alexander Curto, Brooklyn, N.Y.

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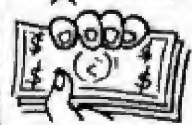


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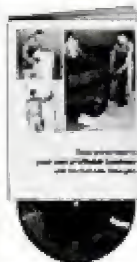
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CAR CLINIC

(Continued from page 44)

size of pinheads had appeared over the body. The dealer tells me they are caused by residue from a nearby foundry. With considerable rubbing, some spots will come off, but they reappear in a few days. Please, what can I do to get rid of these spots? I'm heartbroken.—Jack Phillips, Osceola, Iowa

Sorry, Jack, but I have to paint a bleak picture. Your trouble does prevail in some areas where industrial fall-out, specifically in the form of iron oxide particles, occurs. The particles imbed themselves in the paint and rust. Light-colored cars—white in particular—suffer from this more than dark-colored cars, so new-car buyers beware.

Repairing the damage depends on the size of the imbedded particles. Small particles can usually be removed by carefully rubbing them out with No. 600 grit sandpaper, and then polishing the area. Larger particles may have to be removed by sanding down to bare metal and re-finishing. The trouble will return if fallout continues. The problem is probably environmental, not with the quality of the paint.

Of course, I may be wrong. I can't examine the car. That's why I urge you to have a factory representative look the car over and/or get it checked by an independent body shop. The paint might be defective, but I doubt it.

SERVICE TIPS

■ If you spot a brownish-colored residue on the rear windshield of your 1975 Granada or Monarch, and if that windshield is equipped with electric rear defroster grid lines, do not use a razor blade to remove the residue. You may cut right through the grid lines, destroying the defroster. The residue is probably solder flux, and it can be easily removed from the glass with denatured alcohol.

■ To resolve an engine surge or off-idle stumbling condition with your Chrysler Corp. car's engine, all you might need do is readjust the carburetor float level to specifications. Carburetors have been equipped with viton-tipped needle valves. It's been found that the chemical composition of some gasolines, primarily unleaded fuel, causes viton to swell, lowering the float level. The needle valve does not have to be replaced unless it is damaged or there's evidence of leaking. ★ ★ ★

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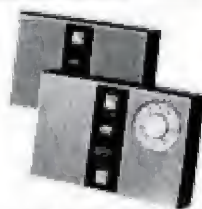
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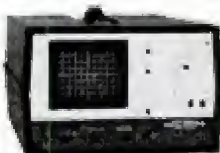
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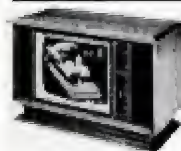
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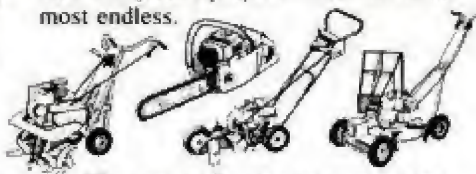
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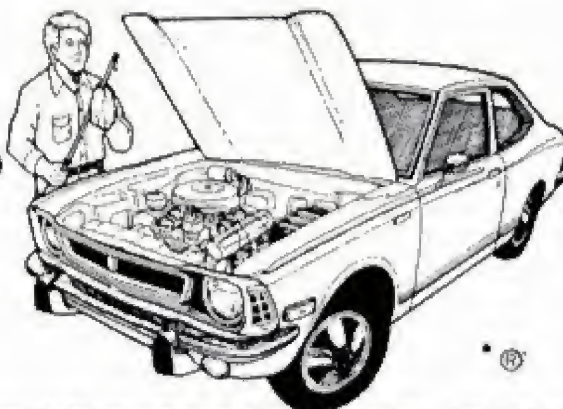
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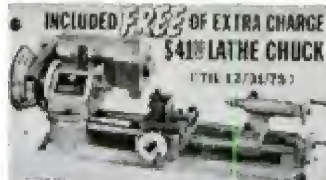
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HOMEOWNERS' CLINIC

(Continued from page 36)

kind of quick mowing you have in mind. This is done as shown in the sketch on page 36. An attractive planting of dwarf evergreens and perennials at each corner of a rectangular lawn permits a sweeping turn of the mower, with no stopping, cramping or extra time taken for trimming.

Refinishing housings

We've purchased an older home with electric baseboard heating units. These look rather dingy and I'm wondering how they might be refinished to appear more pleasing to the eye. Can they be painted?—Mrs. J. Bagwell, Tacoma, Wash.

The housings of these units are not ordinarily subjected to high heat, and I think it would be quite safe to use the interior enamels supplied in aerosol containers. First, the housings should be removed and thoroughly cleaned with steel wool to remove dust and grime and roughen the surface slightly. Then take the housings outdoors and spray them as directed on the containers. You can, of course, use a brushing enamel, but you'll get a somewhat more professional job by spraying.

Aging floor

Hardwood floors—of oak—in my older home seem to be turning progressively darker, the discoloration being uneven, darker in some areas, lighter by contrast in others. Could this be due to wax having been applied years ago? What can I do to lighten the floors uniformly?—Ronald Dixon, Erie, Pa.

Oak floors tend to darken with age and not always uniformly, owing mainly to variations in grain and texture. Removing the wax may have some effect in getting out ground-in dirt and grime, but I think it better and more satisfactory in the long run to sand the floors and remove the old finish down to bare wood. Only then can the wood be refilled and refinished to look like new again.

For additional information more on refinishing hardwood floors, see next month's PM. ★ ★ ★

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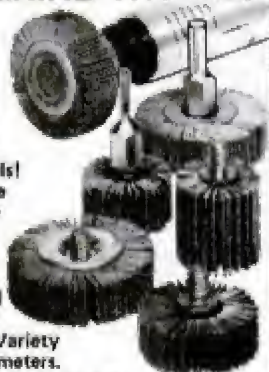
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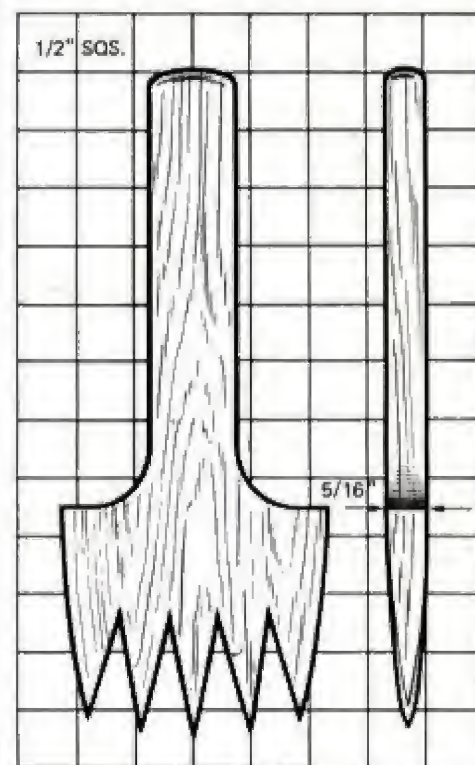
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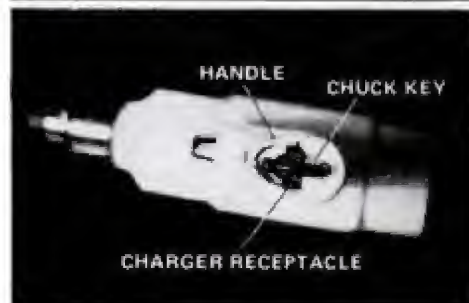
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SPECIFICATIONS—Model 2002 Cordless Drill

Battery charger: Input voltage, 115 v.a.c.

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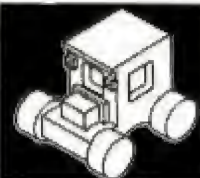
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(Continued on next page)

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(Continued from preceding page)

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(Continued from preceding page)

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